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ABS Research

Introduction to Asset-Backed CDS

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SECTION I: INTRODUCTION

Introduction[1]

A Credit Default Swap (CDS) is a bilateral contract between a protection buyer and a protection seller referencing an underlying reference obligation for a fixed maturity. The contract stipulates that in exchange for a fixed premium that is paid a pre-set number of times a year on an agreed upon notional amount, the protection seller will make whole any credit losses incurred on the underlying obligation. As in any swap, no money changes hands at inception. As a result, CDS are viewed as instruments to "synthetically" transfer the credit risk of an asset in contrast to the more conventional route of selling the asset outright and receiving cash in exchange. Indeed, one could even argue that they resemble insurance contracts more so than swaps since most periodic payments go one way, from protection buyer to seller. It is only when a credit event is declared that the seller of protection is obligated to make any payments if the terms of the contract so dictate.

While CDS contracts are no longer a novelty in the credit markets, more recently the pool of reference obligations has been broadened to include asset-backed and mortgage-backed securities. The purpose of this primer is to introduce our readers to this latest round of innovation in the credit markets. In doing so, we recognize fully that CDS, in their general form, may still be new to some in our audience which traditionally has focused on the buying and selling of "cash" as opposed to "synthetic" instruments. In order to fill this gap, we also provide a brief history of developments in the corporate CDS markets. This discussion will be useful in another respect - highlighting some of the differences between the corporate and asset-backed varieties of CDS contracts. For those of our readers already familiar with much of this background material, we suggest skipping ahead directly to section 3 which introduces single-name Asset-Backed CDS.

Historical Background

Over the last 10 years, the credit derivatives market has emerged as an important component of the overall derivatives market. The evolution of this market is the culmination of a process that began to unfold with the securitization markets. A key feature of securitization - the bundling of pools of individual assets in an bankruptcy remote vehicle for sale in the capital markets - was that it broke the link between origination and the funding and risk-taking involved in the creation of risky debt. Until the emergence of the securitization market, all three functions resided in one institution, the deposit-taking local bank that invested short-term deposits in long-term assets, primarily mortgages. The Mortgage-Backed-Securities (MBS) market changed all that, allowing financial institutions to specialize in the functions in which they had a natural competitive advantage, such as originating loans and servicing them. In return, the onus of funding and holding the risk was shifted on to capital market participants, such as the Government-Sponsored-Enterprises (GSE), life insurance companies, pension funds, etc. Indeed, one can argue that it is precisely this development that allowed specialty finance companies to emerge as "pure" originators in the auto loan, credit card, and mortgage-backed sectors since they could finance their origination programs and transfer the credit risk using the capital markets. It took two decades for this process to come to its full potential, and one can truly claim that the US ABS and MBS markets are one of the best functioning in the world in their ability to fund almost $10 trillion in outstanding assets.

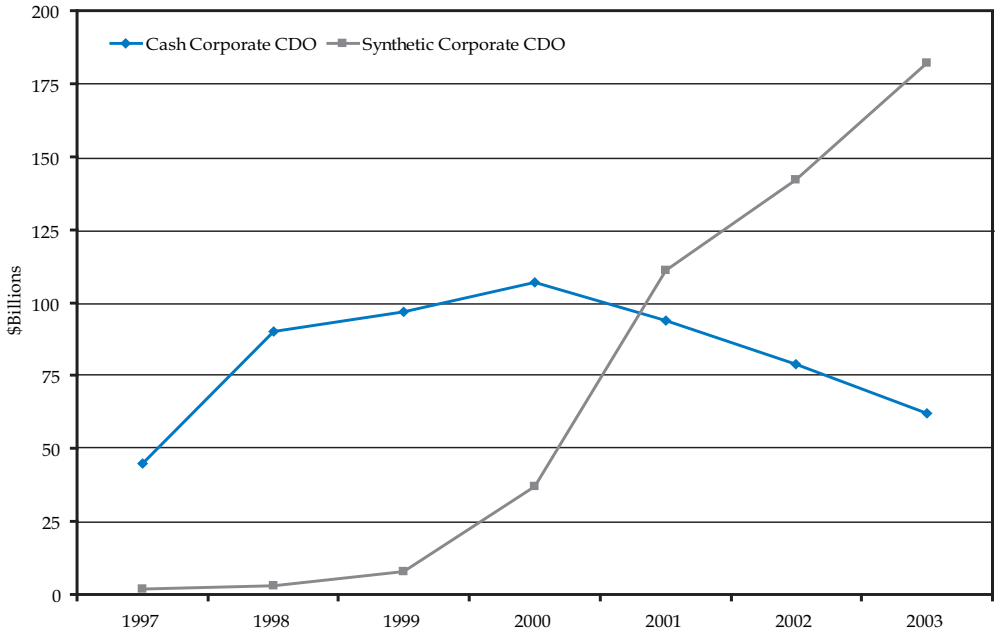
The synthetic market evolved as the second step in the securitization process. As financial institutions became larger and were able to fund themselves efficiently and cheaply in the capital markets, the funding advantage of the capital markets shrank. In addition, for certain assets such as corporate loans, the sale of the loan was deemed as cumbersome since it broke the close link between banker and borrower. Unlike granular assets like mortgages and credit cards, corporate lending was viewed as one where the relationship between the lending institution and the borrower was viewed as a highly negotiated business. In such a situation, since funding could be had just as cheaply on the balance sheet and the sale of the loan (and the potential impediment to the continuation of a healthy relationship) was not considered desirable, a "syn-

1. *We would like to thank Louis Nees, Todd Kushman and Dmitry Pugachevsky for many helpful discussions during the writing of this primer.*

thetic" transfer of credit risk emerged as a viable risk-management tool. The first synthetic securitizations used pools of corporate loans and were issued by large commercial banks such as JP Morgan and National Westminster. In a synthetic risk transfer, the lender pays a premium for protection on a pool of assets to a third party, a protection seller. As should be clear from the description presented earlier, the structure is called "synthetic" because it mimics a cash sale of the asset to the protection seller, but the sale is executed using a derivative contract. Therefore, the risk is effectively transferred, albeit synthetically.

Synthetic transactions have been further utilized in the corporate bond market through the introduction of a more specific risk transfer instrument, the single-name credit default swap or CDS. Although CDS first emerged in 1993, they did not become widely available and used until 1997. Since then, this market has grown remarkably, most notably in the corporate sector because the assets to be first actively and liquidly traded synthetically were corporate bonds and loans. The market has seen not only a dramatic growth in the total notional value of contracts written on single name corporates, but this growth has contributed to a paradigm shift from cash to synthetic transactions. Figure 1 below shows how the growth in synthetic Collateralized-Debt- Obligation (CDO), created from pools of single name CDS, has occurred in conjunction with the slowing growth rates in cash CDO issuance. It should also be noted that the growth of the new "single-tranche" style of synthetic CDO, utilizing a correlation book could not have occurred without the development of a liquid single-name default swap market in the underlying names as well as the standardized indices composed from these names.

Figure 1: CDO Issuance



Source: Bear Stearns

In many ways, the synthetic market in corporate risk can be regarded as having come full circle. The first transactions referenced pools of risk and were used to transfer risk from balance sheets. As the single-name market developed, the need to move risk in pool form went away since it could be hedged on a individual name basis. Finally, as the single-name market itself developed, a pooled market in the names emerged which investors could use as a hedging tool as well as a source of spread income.

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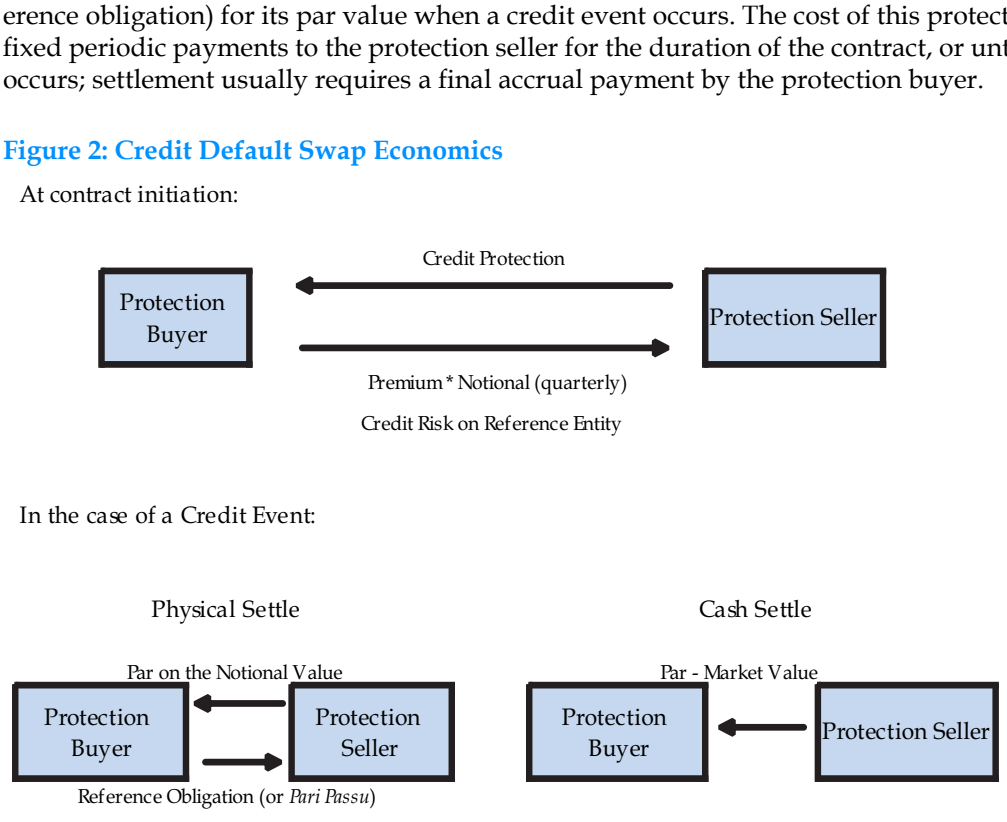
SECTION II: REVIEW

Corporate CDS: A Review

A CDS is a contract between a party who buys default protection on some reference entity, and the counterparty that sells that protection. The default of the reference entity is called a credit event, and the buyer of the protection obtains the right to sell a particular bond issued by the reference entity (known as the reference obligation) for its par value when a credit event occurs. The cost of this protection takes the form of fixed periodic payments to the protection seller for the duration of the contract, or until such a credit event occurs; settlement usually requires a final accrual payment by the protection buyer.

Figure 2: Credit Default Swap Economics



In corporate credit markets, the CDS is settled either by physical delivery of the reference obligation or by a cash payment where the value of the reference obligation following the credit event is determined by an auction / dealer poll. Under cash settlement, the poll establishes a mid-market price R of the reference security and settlement is for (100- R)% of the notional principal, paid to the protection buyer. Under physical delivery, the protection buyer has the option to deliver any "borrowed money" obligation with the same subordination. This gives the protection buyer the option to deliver the cheapest bond with the given subordination.

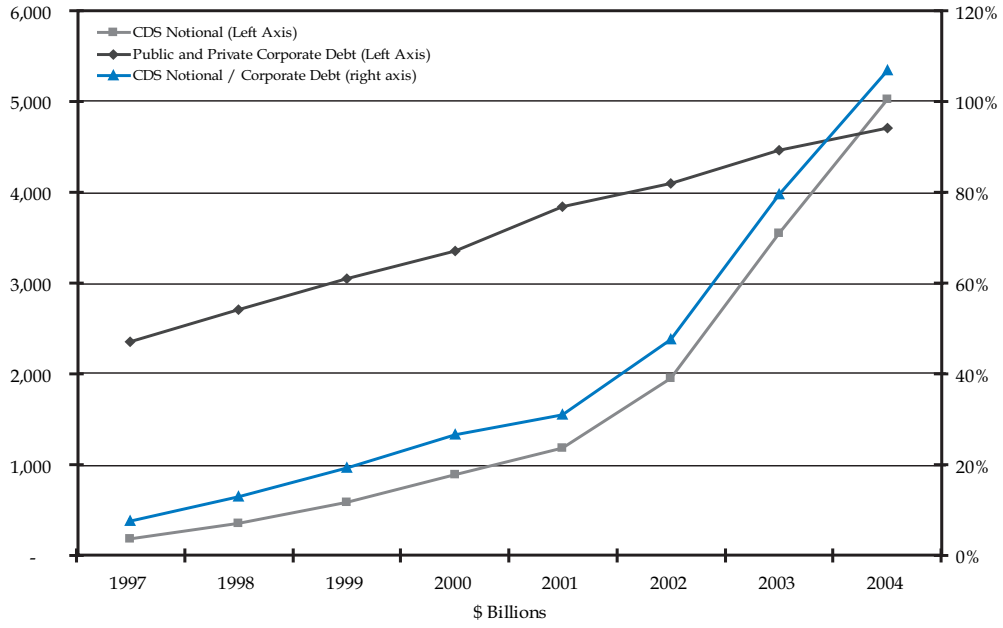
A CDS is a form of a put option, but the ability to exercise is only triggered by a credit event. Also, instead of purchasing the option outright in one payment, periodic payments are made in the case of CDS, and only up until a credit event takes place. The protection buyer does not have the option of canceling the insurance payments for the remaining contract term prior to maturity, so the analogy with some other forms of insurance goes only so far. Instead, the protection buyer must unwind the CDS by selling it in the open market.

When a CDS is negotiated, the current market price of protection is such that the contract has zero value at that time. CDS spreads are typically quoted on a quarterly basis, and the most liquid market is for the 5-year maturity. There is no payment by the buyer at the start of the contract, and the fixed periodic payments are made in arrears. Importantly, CDS have been able to separate funding from credit by allowing trading in an unfunded swap format. The major effect of this has been that the credit markets have become more accessible to investors with high funding costs and those looking to leverage credit risk in either direction. In effect, these products have given an investor the flexibility of doing anything that the cash

market does and much more. For example, there have been instances of CDS on issuers with no tradable debt.

These features have led to an exponential growth of the CDS market over the past decade, particularly since 1998 when the International Swaps and Derivatives Association (ISDA) standardized the terminology in credit derivatives transactions. This has been most notable in corporate CDS that were the first assets to be actively traded. The total CDS Notional has exceeded the cash supply of debt in most corporate names. Figure 3 presents a comparison of corporate debt and CDS notional outstanding at the end of 2004.

Figure 3: Corporate Debt and CDS Outstanding



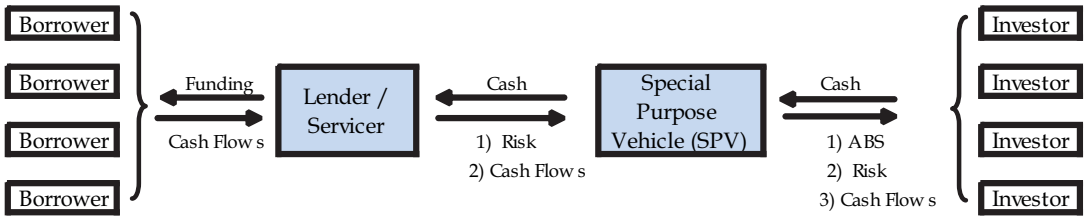
Source: British Bankers' Association, Bloomberg, BMA

In our view, the increasing maturity and sophistication of the corporate CDS market will only aid the development of newer forms of risk-transfer, such as CDS on ABS. Much of the groundwork for the development of the market has been laid already, and more importantly, participants have a frame of reference to understand the pitfalls that arise in the process of transferring risk synthetically. Before we go on any further however, and in recognition of the fact that a synthetic market has the potential to draw in many new investors, we provide a brief review of the ABS markets themselves.

Asset-Backed Securities: A Review

The key element of asset-backed securitization (ABS) is the establishment of a "bankruptcy remote" special purpose vehicle (SPV) structured to hold pools of individual assets and provide cash flow to its bondholders. We use ABS in a generic sense to include all securitization vehicles encompassing both RMBS and CMBS assets. A typical structure is shown below.

Figure 4: Asset-Backed Security Structure



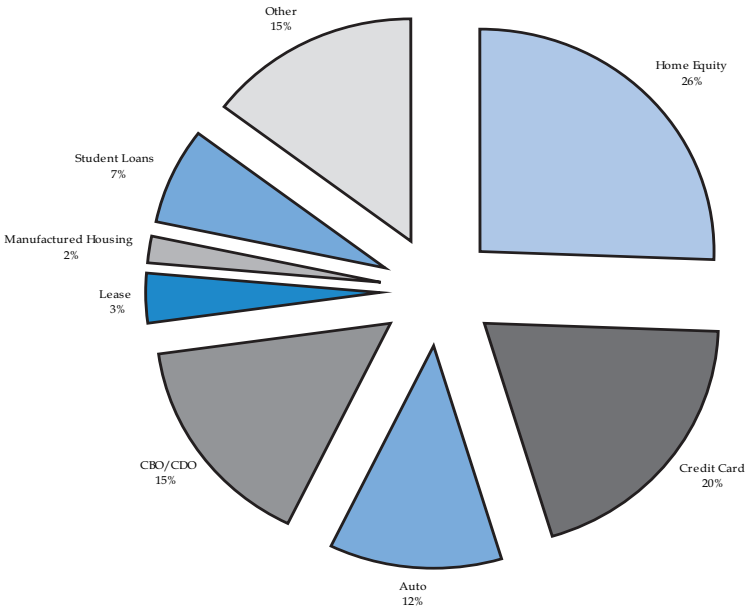
There are two basic variants of ABS/CMBS structures:

a) **Master Trust Structures (Revolving Structures):** A pool of receivables is transferred to a master trust and the master trust then issues one or many series of notes backed by these receivables. Most master trusts have a revolving period during which any principal payments received on loan balances are used to purchase additional receivables instead of paying off existing notes. In many instances this is followed by an accumulation period when principal payments are accumulated in a separate account. The final phase is the amortization period when the accumulated and new payments are used to pay down a set of issued notes. These amortizations have evolved such that principal is repaid over a pre-determined time period or close to a single date - almost bullet-like. Credit cards are usually securitized through such structures.

b) **Closed End Structures (Senior/Subordinate Structures):** No new receivables are added to the securitization pool on an on-going basis and there is only one series of notes that are issued on the assets to be securitized. Credit enhancement is usually done through excess spread and some combination of mortgage insurance, reserves, overcollateralization, subordination and monoline insurance. These are typically structured so that mezzanine and subordinate classes may begin receiving principal after a pre-determined lock-out period, subject to certain performance triggers. Home equity deals are usually securitized through such structures.

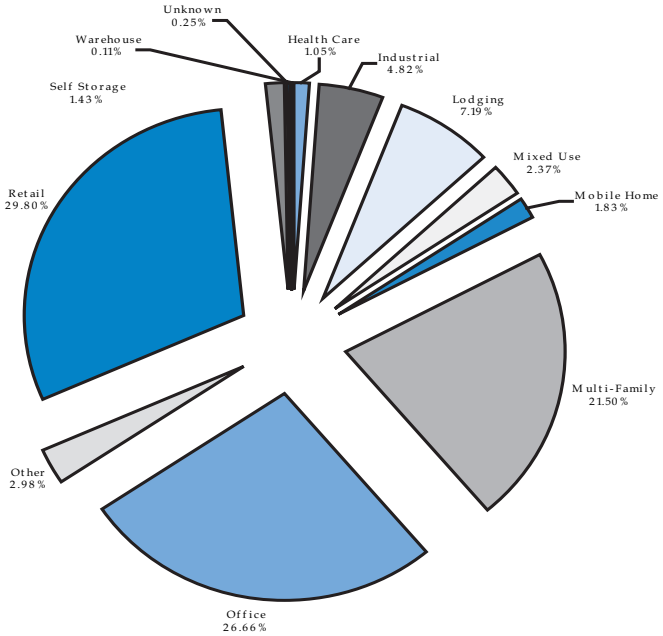
A wide variety of assets, such as home equity loans, auto loans, credit card receivables, student loans, vehicle leases, and many others have been securitized in this fashion and sold to investors. A general rule is that any asset with "reasonably" predictable cash flows can be (and probably has been) securitized as can be seen below from a sector-wise break-up of outstanding ABS/CMBS.

Figure 5: ABS Outstandings - Q2-2005



Source: BMA

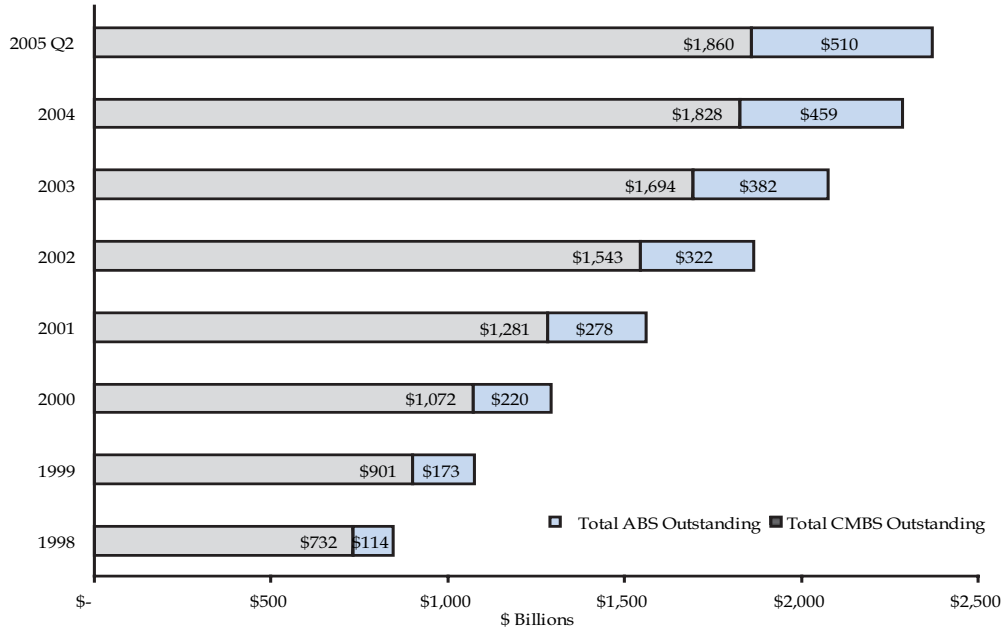
Figure 6: CMBS Outstandings - Q2-2005



Source: Trepp

Though some sources in academia have traced the roots of securitization as far back as the 1400s (!), the real growth of the ABS market started in the 1980s. The market for publicly offered ABS issuance was $1.2 billion in 1985 (source: BMA) and since then it has grown exponentially to a new record of $671 billion in 2004 ($339 billion till May 2005. Source: BMA). This growth clearly is not showing signs of slowing in the near future. The compound annual growth rate of ABS public issuance was 20% between 1999 and 2003 and issuance has grown over 40% in just 2004 over 2003.

Figure 7: The Growth of the ABS/CMBS Market



Source: BMA, Trepp

Until now, the ABS market has provided investors the opportunity to only go long risk on the underlying assets. Shorting ABS in the cash market is extremely difficult and some would argue, well nigh impossible. As a result, there has been no easy way for investors to express a negative view on the overall ABS markets or specific segments of it. In addition, due to the lack of shorting vehicles, investors could not hedge existing ABS positions. Originators wishing to hedge asset pipelines while ramping up an ABS structure have also found themselves taking on execution risk between ramp-up and pricing. An important reason for this situation is the fact that the vast proportion of the capital structure of an ABS transaction consists of highly rated securities. Thus, the outstanding "float" in securities that could legitimately be viewed as being "risky" is generally so small as to create the potential for a short squeeze. In addition, a significant concern in the shorting of cash bonds is the funding disadvantage for the typical speculators (such as hedge funds) that are the driving force behind relative value plays in the credit markets. It is not surprising therefore that the capital markets would look to synthetic ABS as a tool to fill this gap.

SECTION III: ASSET-BACKED CDS MARKET

Growth of Asset-Backed CDS

Synthetic risk-transfer in ABS markets in not a new phenomenon but what is new is the use of single-name CDS to synthetically transfer risk. Until the emergence of the single-name variant, synthetic ABS technology had been applied primarily in the securitization context. Examples of these transactions include the Freddie Mac MODERNs deal, Toyota's Gramercy Park automobile lease transaction, the BankAmerica RESIF deal and the HSH CMBS transaction. Importantly, the synthetic ABS sector was viewed as a creative alternative to traditional securitization rather than an active market for the trading of credit risk in ABS. There was very clearly the need for the development of a market in single-name Asset-Backed CDS. However, the growth of a liquid Asset-Backed CDS market was hindered in the past few years by the lack of standard documentation for the product, the relative non-existence of an investor base to short or hedge ABS risk and the abundance of cash CDO collateral in the market.

This has changed in the past year and the trading of the single-name Asset-Backed CDS has increased from a negligible amount in 2003 to almost $75-$100 billion through November 2005. Most of this increased volume has been equally divided between RMBS and CMBS assets while smaller volumes have traded on CDOs/Credit Cards/Autos. Most RMBS CDS trades have been on the triple-B rating bucket while CMBS trades have been divided equally between triple-A and triple-B rating buckets.

This has been driven primarily by consistency in contract documentation, difficulty in sourcing collateral by cash CDO managers and the interest of market players like hedge funds in exploiting any pricing inefficiencies in the ABS market. ISDAs release of standard confirmations for Asset-Backed CDS has made the market more liquid by removing most of the burdens stemming from non-standard documentation. It has led to a vibrant secondary market in Asset-Backed CDS as investors are able to easily assign existing deals and get competitive quotes across the dealer community for unwinding or putting on new trades.

Asset-Backed CDS Investor Base

A look at the potential investor base for Asset-Backed CDS gives us an idea of the growth potential of this market in the next few years.

Protection Sellers

The demand for selling protection arises largely from the same group of investors that currently invest in cash ABS. Asset-Backed CDS serves as a good substitute for taking on ABS risk in sectors where cash issuance tends to be constrained. This is an increasingly common phenomenon in the lower rated parts of the capital structure as increasing demand from ABS CDOs often leads to a paucity of cash bonds for other investors.

CDS on ABS allow investors or CDOs to gain exposure to a sector quickly and in size. While accumulating $250 million in BBB rated cash HEL securities could take as much as three to four months, the CDS market allows an equivalent sized exposure to be taken on in the course of a single day. In addition, a CDO can structure its underlying asset portfolio in different forms using Asset-Backed CDS to reference diverse issuers, sectors or vintages that may not be readily available in the cash market.

Leveraged investors such as hedge funds constitute another source of demand. They can use the unfunded synthetic ABS market to express views on ABS credit using higher leverage than currently offered through the cash ABS market.

Protection Buyers

At first glance, there would seem to be less demand for protection buying since structural features in ABS are designed to avoid defaults and most ABS are investment-grade rated, giving investors little incentive to buy protection. Also, while institutions like banks have natural credit exposures to corporates through loans, derivatives transactions etc., the same is not usually true of credit exposures to ABS structures.

However, first glances can be misleading and there exist ample sources of demand for buying ABS protection.

A large source of demand is from investors looking to express a negative view on ABS credit. This has historically been impossible through the cash market because of the lack of a liquid repo market in ABS bonds. Another source of demand comes from ABS issuers hedging their deal pipeline who may be looking to hedge the risk that spreads would widen while they are in the process of completing their structure.

Two-Way Interest

Hedge funds or other relative value players serve as important constituencies in both the protection buying and selling markets. In doing so, they may be looking to exploit any price inefficiencies across rating classes or within a CDO capital structure, trading the basis between the cash bond and the CDS or attempting to manage any correlation risk from CDO trades. Non-originator banks can access markets without the need for a platform and can take a view on a sector spreads in either direction.

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SECTION IV: ASSET-BACKED CDS vs. CORPORATE CDS

Unique ABS Bond Characteristics

Before we discuss the features of asset-backed CDS, it may be helpful to first understand the unique characteristics of ABS. This will aid us in determining the validity of applying terms specific to the corporate market to the ABS market.

Principal Payments - Both prepayment uncertainty and principal write-downs change the outstanding notional of the ABS bond over its life. As a result, it would make sense to amortize the notional of the asset-backed CDS as well. This is different from a corporate bond (and thus the notional of a corporate CDS) that usually has a fixed bullet repayment at maturity.

- **Prepayment Uncertainty** - This does not occur in corporate bonds that have a fixed amortization schedule. However, ABS bonds can get prepaid as and when the underlying assets - RMBS, CMBS, and credit card receivables etc. - get prepaid. This creates uncertainty about the amortization schedule in ABS cash bonds and thus a failure to pay according to a fixed amortization schedule would be difficult to justify as a legitimate credit event.

- **Principal Write-downs** - In contrast to corporate bonds, principal on ABS bonds may be reduced. This can happen if losses on the underlying assets exceed available credit enhancement or if principal payments from underlying assets is used to pay any interest shortfall. Most ABS bonds have a provision for this write-down to be reimbursed if the underlying assets start performing again. It may be inappropriate to classify such an event as a default event unless the write-down is relatively large or has been outstanding for a long time without any possibility of recovery in the future.

Interest Payments / Interest Shortfalls - Again, in contrast to corporate bonds, many ABS bonds have the flexibility to alter interest payments when cash flows from underlying assets are insufficient to repay bond interest. This can occur in two main ways:

Payment In Kind (PIK) - In this case the bonds accrue interest by adding the shortfall amount to the outstanding principal balance. The accrued interest in most cases also compounds until it is repaid. These interest shortfalls can be reimbursed if performance recovers but there can be instances when this becomes a permanent loss. Again, it may be inappropriate to classify such an event as a default until the PIK-ing is too large or has been outstanding for a long time.

Available Funds Cap (AFC) - This is most common in US HEL ABS but is also prevalent in US RMBS and certain European CMBS. The interest rate cap stems from the fact that ABS bonds are usually floating rate instruments while the underlying collateral may have a large percentage of fixed rate or hybrid-ARM products. This creates the possibility of interest inflows being smaller than interest outflows if the coupon on the ABS tranches (floating rate index plus margin) is higher than the weighted average net coupon on the underlying collateral. To prevent this imbalance, bond interest is capped at available funds, which is the weighted average net coupon on the underlying collateral. This is an inherent interest shortfall risk for the buyer of the cash bond and thus it makes sense for the Asset-Backed CDS to have a similar feature if it is to mimic the underlying bond.

Change in Credit Profile - De-levering - This primarily holds for subordinated tranches that effectively get a higher credit enhancement as the higher tranches pay down either with time or on account of breaches in some structural covenants. This obviously lowers the credit risk of these tranches and does not have any parallels in a corporate bond. Such a de-levering brings down the spread on the cash bond and should correspondingly bring down the Asset-Backed CDS spread too.

Tenor - (*Legal Final Maturity vs. Average Life or Expected Life*) - ABS bonds have long legal final maturities that reflect the tenor of the long-maturity assets like residential mortgage loans etc. in the underlying pool. However, their expected life is not very long since they pay down much earlier because of prepayments. A measure used by the market to gauge their expected maturity is the weighted average time of principal

repayments or average life. While most contracts would tend to match the legal final maturity of the underlying ABS bonds, it is possible to have contracts that have shorter maturities nearer the expected life or average life of the ABS bond. However, shorter maturity Asset-Backed CDS can leave a protection buyer open to "default" risk between the time the CDS matures and the final maturity date of the cash bond.

Uniqueness of Reference Obligation (RO) - The performance of an ABS bond is very specific to a particular pool of collateral and its place in the capital structure and not highly dependent on the issuer of the ABS. This is because credit performance of the cash bond varies depending on:

Vintage - year of origination - different years have different quality of assets based on factors like economic conditions, underwriting standards etc. For example a 2004 RMBS pool might have more default-prone borrowers than a 2002 pool because rising home prices may have increased the credit quality of many subprime borrowers.

Asset mix - different bonds can have different underlying assets and thus very different credit risks.

Seniority - structurally, the subordinate bonds in an ABS transaction absorb losses before the senior bonds and thus are more prone to default.

Therefore, unlike a corporate CDS that references any "borrowed money obligation" of a reference entity, an Asset-Backed CDS is specific to a reference obligation and has no "cheapest-to-deliver" option (except in the case of master trust structures like credit cards).

Management Control Over Defaults - Usually the management of any corporation exerts control over the ability or timing of the default decision through small changes in the capital structure, operational effectiveness, labor force, market strategy etc. However, an ABS is ruled by strict covenants and structural features that the manager or the trustees have very little control over. This would imply that there is less early jump-to-default risk and a higher probability of back-ended defaults.

These unique ABS characteristics have lead to the formulation of an Asset-Backed CDS contract distinctly different from the Corporate CDS contract. Table 1 highlights some of these differences.

Table 1: Structural Comparison - Corporate CDS and ABS - CDS

Characteristic	Corporate CDS	Asset-Backed CDS
Reference Entity	- Corporate Bond / Loan	- Asset Backed Security
Reference Obligation	- Cheapest-to-Deliver Option	- Specific Reference Obligation
Notional Amount	- Fixed (No Uncertainty) - No Prepayment risk - No Writedown risk	Varies with notional of cash bond primarily on account of 1. Prepayments 2. Writedowns
De-levering	Not Applicable to the bond	Possible due to structural features
Control Over Default	Management discretion	Structural features of the bond
Interest Shortfall		
1. AFC	Not Applicable	Applicable in CDS on certain type of ABS
2. PIK	Not Applicable	Applicable in CDS on certain type of ABS
Settlement Method	- Physical - Cash (Market Valuation Process)	- PAUG (Pay-As-You-Go) / Physical Settle - Cash / Physical Settle
Scheduled Termination	2 / 5/ 7 / 10 years common	Depends on type of CDS settlement 1. PAUG - Legal Final Maturity of ABS Bond 2. Cash Settle - 5 years at present (other maturities might develop)
Premium (Fixed Rate)	Fixed at Origination	Depends on type of CDS settlement 1. PAUG - Fixed at Origination Adjusted for shortfalls or reimbursements and step-up 2. Cash Settle - Fixed at Origination
Floating Rate	Not Applicable	Depends on type of CDS settlement 1. PAUG - Includes Interest Shortfalls, Principal Shortfalls, Writedowns 2. Cash Settle - Not Applicable
Credit Events	 - Failure to Pay - Bankruptcy - Restructuring (For Some)	Depends on type of CDS Settlement but in general - Failure to Pay - Writedown - Ratings Downgrade - Maturity Extension - Bankruptcy (more for regulatory capital purposes)
Fixed Rate Frequency	- Typically Quarterly - Standardized Payment Dates 20th - Mar, Jun, Sep, Dec	- Frequency of ABS Bond payments usually monthly
Assignment	-Available (subject to counterparty approval) - Cash transfer is PV of spread differential	-Available (subject to counterparty approval) - Cash transfer is based on cash flow valuation

SECTION V: ASSET-BACKED CDS CONTRACT

Asset-Backed CDS Contract Terms

The Asset-Backed CDS contract has been structured to account for these unique features of the underlying ABS cash bond. The contract has two main variants based on the manner in which it is settled after a credit event:

1. Pay-As-You-Go (PAUG)/Physical Settle
2. Cash / Physical Settle

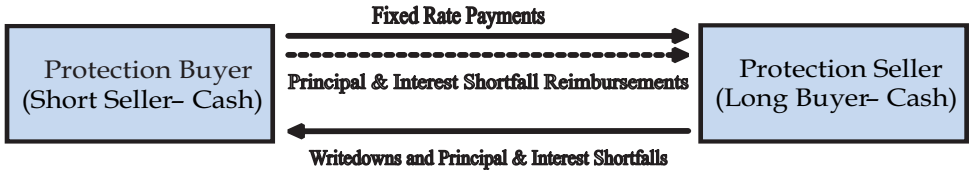
Currently almost all of the US Asset-Backed CDS are traded PAUG/Physical Settle while contracts traded in Europe are traded Physical/Cash Settle to primarily try and mirror the performance of the master trust structures commonly used in the European securitization market. The belief probably is that upon a Failure to Pay of a master trust an investor is indifferent to holding the cash security or to market valuation. We do not believe this is the case as master trust structures can live for a significantly longer time than the settlement period (120-140 days) after the credit event, therefore yielding a materially different performance and recovery rate.

I. Pay-As-You-Go (PAUG)/Physical Settle Asset-Backed CDS

The contract is structured to mirror the flows on the underlying reference obligation to its Legal Final Maturity Date. The protection buyer pays a fixed rate to the protection seller who makes the protection buyer whole for any Writedowns, Principal Shortfalls or Interest Shortfalls experienced by the reference obligation. However, if the reference obligation reimburses these amounts to the cash bond holders then the protection buyer has to pass them back to the protection seller.

In case there is a credit event, the protection buyer has the option to either physically settle and deliver the underlying reference obligation or continue with the existing contract. This option can be exercised by the protection buyer after the conditions for settlement are met.

Figure 8: PAUG ABS Economics



Credit Events that trigger the settlement option are:

I. Writedown

This is defined in three different ways depending on the terms of the reference obligation.

i) Actual Writedown

If the terms of the reference obligation provide for a Writedown, it is defined as the applied loss resulting in a reduction in the Outstanding Principal of the reference obligation.

ii) Principal Deficiency Ledger (PDL)

If the terms of the reference obligation provide for a PDL, it is defined as an attribution of a principal deficiency or realized loss to the reference obligation resulting in a reduction of the interest payable by it.

iii) Implied Write Down (Undercollateralization)

If the terms of the reference obligation do not provide for a writedown, it is defined as the difference between the Implied Writedown amounts for the current calculation period and the previous one. Implied writedown is typical for AAA CMBS/RMBS bonds that might not suffer writedowns but could get undercollaterized.

To calculate the Implied Writedown for a period the Outstanding Principal Balance of the reference obligation is added to that of all obligations of the reference entity secured by the same underlying assets and ranked pari passu or senior in priority to the reference obligation. This is then reduced by the aggregate outstanding asset pool balance to come up with the result, if it is a positive quantity.

II. Failure to Pay Principal

This gets triggered when the issuer of the reference obligation (or an insurer if applicable) misses a Scheduled Principal Payment or pays a lesser amount at a date, most commonly the legal final maturity date, when the Scheduled Principal is legally due.

The Scheduled Principal Payment is calculated as the product of the notional amount due on that date and the Reference Price. The Reference Price is par in most cases, except where the reference obligation is at a deep discount or high premium, in which case it reflects that discount or premium.

III. Distressed Ratings Downgrade

A specific ratings change by any one or more of the rating agencies. If the reference obligation gets downgraded to or below Caa2 (Moody's) or CCC (S&P/Fitch) or its rating is withdrawn then a credit event is triggered.

If immediately prior to withdrawal, the reference obligation was rated at or higher than Baa3 (Moody's) or BBB- (S&P/Fitch), then, if the reference obligation is assigned a rating of at least Caa1(Moody's) or CCC+(S&P/Fitch) within three calendar months of such a withdrawal, it does not constitute a credit event.

IV. Maturity Extension

This is triggered if there is an extension of the legal final maturity date of the reference obligation after the CDS contract has been entered into by the two parties. The protection buyer can exercise the triggered settlement option at the original legal final maturity of the underlying reference obligation.

Treatment of Step-Up Coupon

The coupon on the outstanding obligations of certain ABS bonds steps-up in case the collateral balance falls below 10% of the initial collateral balance. In line with such a step-up provision that exists in certain ABS reference obligations, in the PAUG contract the protection buyer has the option of choosing between stepping-up the fixed rate whenever there is step-up in the reference obligation or early termination of the contract at that point in time. This is similar to the option held by the servicer of the reference obligation and ensures that the protection buyer does not get shortchanged if the servicer decides not to call the bond for his/her own economic benefit.

Treatment of Interest Shortfall

Interest Shortfall can occur in ABS cash bonds on account of either a credit event or because of certain mechanisms like available funds cap. Interest shortfall is defined as the difference between the Expected Interest and the Actual Interest. The calculation of Expected Interest is done without taking into account any limited recourse provisions of the underlying assets that provide for capitalization of interest (an available funds cap) or deferral of interest (payment in kind).

Expected Interest is usually LIBOR plus the notional margin for floating rate bonds while it is the fixed coupon for fixed rate bonds. However, if a floating rate reference obligation has a hard cap then the Expected Interest is the lesser of the hard cap and LIBOR plus the notional margin. For WAC bonds (commonly CMBS and Alt-A mezzanine bonds) the Expected Interest is the pass-through rate paid to the holder of the reference obligation i.e. Expected Interest moves lower in case the collateral WAC is lower on account of prepays of higher coupon loans. Current ISDA templates do not directly address WAC bonds but CDS transacted on any such bonds add the above definition in the contract.

Interest Shortfall is not defined as a credit event in ISDA's June 21st publication, rather its occurrence requires that the protection seller make a payment for the same to the protection buyer. If there is an interest shortfall in one period that the protection seller has made the protection buyer whole for, such amount compounds at the rate of LIBOR plus the fixed rate until repaid. However, consistent with the practice in the underlying cash CMBS bonds, interest shortfall amounts do not get compounded when the reference obligation is a CMBS security.

There are three variants of how the payment for Interest Shortfall can be made.

Interest Shortfall Variants

1. Fixed Cap - In this case the maximum amount that the protection seller has to pay to the protection buyer is the Fixed Rate. Therefore, the worst case for the protection seller is receiving no Fixed Rate for providing principal protection. On the other hand, the protection buyer takes the risk of not being protected on the full interest shortfall of the reference obligation.

This has been adopted as a market standard since it most resembles a credit trade. A "pure credit trade" would have no reduction in the Fixed Rate when non-credit Interest Shortfalls are experienced.

In ABS transactions, it is operationally difficult for the trustee to differentiate between credit-related Interest Shortfalls or those because of an available funds cap. The Fixed Cap option is the closest to a credit trade that one can create when referencing RMBS securities exposed to AFC risk. When referencing an RMBS security, protection sellers preferring to minimize the interest rate risk due to an AFC would prefer to trade Fixed Cap as AFC risk is capped at the Fixed Rate for each calculation period.

For CMBS, the Fixed Cap best resembles a credit trade since all Interest Shortfalls are credit related (there is no AFC Cap).

2. Variable Cap - In this case the protection seller has to make up any interest shortfall on the bond to the extent of LIBOR plus the Fixed Rate. AFC risk up to LIBOR plus Fixed Rate is taken on by the protection seller and the protection buyer receives protection for the same. Clearly, the fair spread in such a case should be higher than that paid for the Fixed Cap variant since the protection buyer gets protected for a higher interest shortfall amount - LIBOR plus Fixed Rate as against just the Fixed Rate.

3. Cap Not Applicable - In this case the protection seller takes on the full AFC risk up to LIBOR plus Bond Coupon and the protection buyer receives protection on the full interest shortfall. There is no cap at either the Fixed Rate (Fixed Cap) or at LIBOR plus Fixed Rate (Variable Cap).

In case the reference obligation is a floater trading at par, then this variant is the same as the Variable Cap one. This is because a par floater will imply a CDS Fixed Rate that is similar to the coupon on the bond. Thus the cap of LIBOR plus Fixed Rate (Variable Cap) will be the same as that of LIBOR plus Bond Coupon in the Not Applicable case.

However, the situation becomes more interesting if the bond is not trading at par. There can be two ways of looking at this. One, adjust the Fixed Rate (CDS premium) to compensate for any additional protection being received by the protection buyer. In the case of a premium bond, the protection buyer pays a higher

Fixed Rate every period than that in the case of a Variable Cap CDS on the same bond. This is because the protection buyer is protected for the entire shortfall amount which is higher than LIBOR plus Fixed Rate in the case of a premium bond. For example, take the case of a bond with a coupon of LIBOR+300 bp trading at a premium and having a protection premium of 200 bp that is lower than the bond coupon. The interest shortfall protection for the Variable Cap CDS would be capped at LIBOR+200 bp but for the Not Applicable CDS would be capped at the higher LIBOR+300 bp.

On the other hand, in the case of a discount bond the fair spread will be the same in both cases since the maximum shortfall amount is always lower than LIBOR plus Fixed Rate. For example, take the case of a bond with a coupon of LIBOR+300 bp trading at a discount and having a protection premium of 400 bp that is higher than the bond coupon. The interest shortfall protection for both the Variable Cap CDS and the Not Applicable CDS would be capped at LIBOR+300 bp since that is the maximum possible shortfall on the bond. Even though the Variable Cap CDS has a higher cap but the difference has no value since the shortfall can never exceed LIBOR+300.

The other way to tackle premium or discount bonds is to set an Initial Payment to "parize" the reference obligation. This implies an upfront payment of the difference between par and the current dollar price of the bond from either the protection buyer or protection seller (depending on whether the reference obligation bond is at a discount or at a premium, respectively). This upfront payment enables the setting of the CDS Fixed Rate equal to the Bond Coupon and then the cap is set to LIBOR plus Coupon which in effect is the same as LIBOR plus Fixed Rate. The market uses this convention for any trades done under the Not Applicable variant.

Let's take a few examples to understand the issues clearly.

Figure 9: Example 1- Variants of Interest Shortfall Cap for a Par Bond

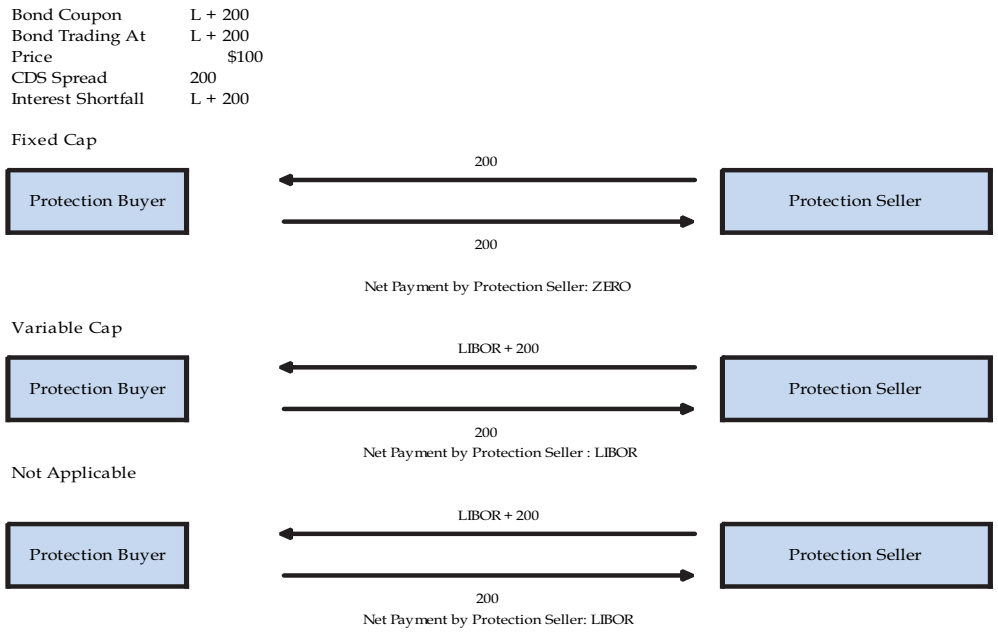


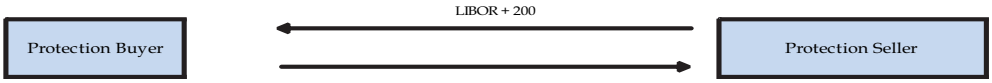
Figure 10: Example 2- Variants of Interest Shortfall Cap for a Premium Bond

Bond Coupon L+ 300
Bond Trading At L + 200
Price $102
CDS Spread 200
Interest Shortfall L +300

Fixed Cap

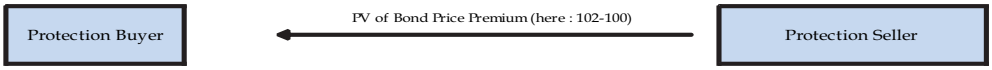
Net Payment by Protection Seller: ZERO

Variable Cap

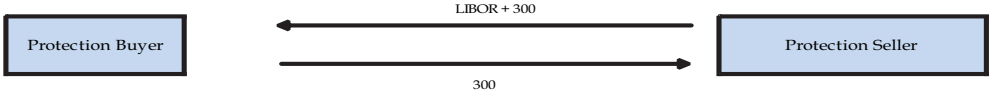


Net Payment by Protection Seller : LIBOR

Not Applicable
At Initiation
CDS Spread 300



At Shortfall

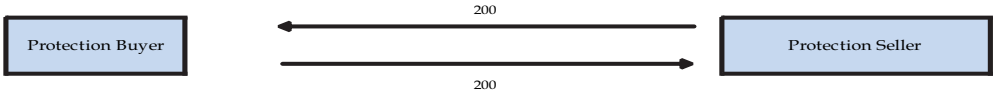


300
Net Payment by Protection Seller : LIBOR

Figure 11: Example 3- Variants of Interest Shortfall Cap for a Discount Bond

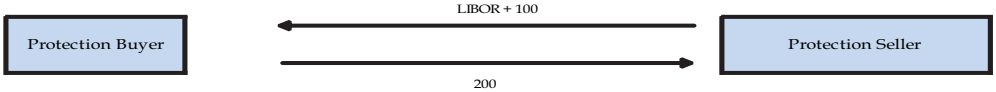
Bond Coupon L + 100
Bond Trading At L + 200
Price $98
CDS Spread 200
Interest Shortfall L +100

Fixed Cap



Net Payment by Protection Seller : ZERO

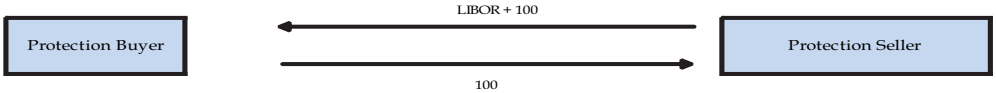
Variable Cap



Net Payment by Protection Seller : LIBOR - 100

Not Applicable
At Initiation
CDS Spread 100

At Shortfall



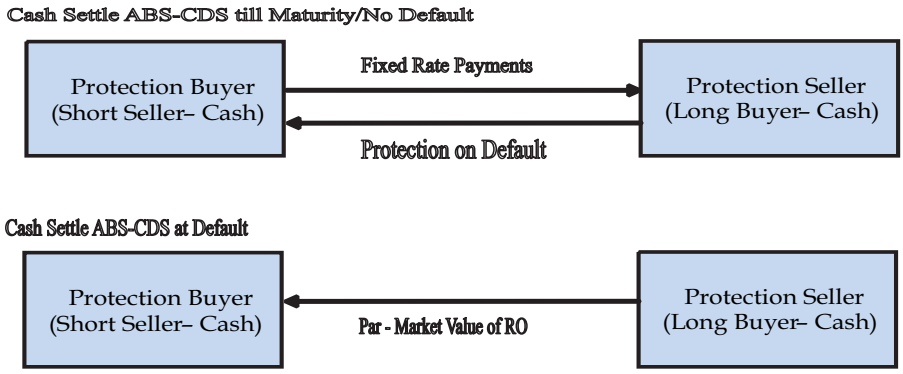
Net Payment by Protection Seller : LIBOR

II. Cash-Settle/Physical Settle Asset-Backed CDS

Contrary to the PAUG contract, the Cash-Settle contract does not mirror the flows on the underlying reference obligation to its Legal Final Maturity Date. The contract is structured like a corporate CDS where a credit event leads to a market valuation process or physical delivery of the underlying reference obligation.

The Protection Buyer pays a fixed rate to the Protection Seller who makes the protection buyer whole for the difference between par and the value of the underlying reference obligation after the credit event. In most cases this contract has its scheduled termination at a date other than the reference obligations legal final maturity date (at present 5 year maturities are most common).

Figure 12: Cash Settle ABS Economics



This contract is similar to an out-of-the-money put option on the underlying cash bond. However, the maturity mismatch gives rise to the risk that the put might have already expired when the investor needs to protect its investment the most.

Credit Events that trigger market valuation are:

I. Failure to Pay ("Payment Shortfall")

This credit event gets triggered under the following different conditions:

i) The reference obligation fails to pay the full outstanding principal balance at the earlier of its legal final maturity or the day on which the underlying assets securing the reference obligation have been disposed off.

ii) The reference obligation (or an insurer if applicable) misses an Expected Payment Amount (defined ahead) by more than $100,000 at a Scheduled Distribution Date and

a) such non-payment allows for an acceleration in payment of the reference obligation or,

b) the terms of the reference obligation do not provide for a reimbursement of the Payment Shortfall (i.e. the shortfall is "permanent")or,

c) the reference obligation does not provide for the Payment Shortfall to compound at a rate equal to or more than its coupon rate until repaid. This may not be appropriate for reference obligations that do not have a PIKing feature because such reference obligations would inherently not have this provision.

The minimum shortfall amount of $100,000 ensures that a credit event is not triggered by an immaterial shortfall in interest or principal payment.

The *Expected Payment Amount* is the *principal or interest* due at the Scheduled Distribution Date. Its calculation is done without taking into account any limited recourse provisions of the underlying assets that provide for capitalization of interest (an available funds cap) or deferral of interest (payment in kind).

However, the Expected Payment Amount does not include any payments or withholdings because of withholding tax. It can also get amended if the Scheduled Distribution Dates are changed for reasons other than deterioration in creditworthiness of the issuer, the reference obligation or the underlying assets of the reference obligation.

iii) Additional Condition - Counterparties have the flexibility to include an additional condition such that if non-payment (of any amount) continues uninterrupted for a certain period, then this credit event is triggered. This is especially important because rating agency studies show that after two years of non-payment the probability of default on such an amount is very high.

It should be noted that while the PAUG contract defines only principal shortfall as a credit event and interest shortfall as a floating rate payment event, the Cash Settle contract defines both as credit events. Importantly, the credit event is triggered only if the shortfalls change the underlying bond's cash flows or are "permanent".

The permanence feature implies that a Failure To Pay might not be clear till the final maturity of the underlying reference obligation which might be much after the maturity of the CDS. However, in a PAUG contract, the payments immediately mirror those on the underlying reference obligation whenever there is an interest shortfall or interest reimbursement.

We believe this is one of the primary reasons why the PAUG contract is becoming a universal standard since it allows traditional cash investors to source a larger stock of risk without materially changing the nature of the underlying cash flows.

II. Loss Event

This event is triggered if there is a reduction in the principal amount of the reference obligation without any corresponding payment of the same to the holders of the reference obligation and the terms of the reference obligation do not provide for:

a) reinstatement or reimbursement of the Principal Reduction (i.e. the reduction is "permanent"), or

b) interest to be paid on the Principal Reduction at a rate equal to or more than its coupon rate until the amount is repaid, or

c) interest to be paid on the interest that would have accrued on this Principal Reduction. Again, this may not be appropriate for reference obligations that do not have a PIKing feature because such reference obligations would inherently not have this provision.

Clearly, in this case only an actual Principal Reduction triggers a credit event and this loss event needs to be irreversible or not pay interest on the reduced amount for it to be classified as such. Similar to Failure To Pay, this irreversibility implies that a Loss Event might not be clear till the final maturity of the underlying reference obligation which might be much after the maturity of the CDS.

This credit event is different from the Writedown event in the PAUG contract where any actual or implied writedown not only triggers the credit event but any actual writedowns also result in a transfer of cash flows from the protection seller to the protection buyer.

We agree with the omission of Implied Writedowns on certain referenced assets like CDOs or possibly certain master trusts. This removes documentation mismatch in such referenced assets but omitting implied writedowns also adds additional uncertainty about the ABS bond and this would make the price of the CDS diverge from that of underlying reference obligation making it less transparent for investors.

This failure to consider Implied Writedowns as a credit event and importantly, the uncertainty about the timing of the credit event is another reason for the increased use of the PAUG contract.

III. Ratings Downgrade

If the reference obligation is rated by only one rating agency and gets downgraded to or below Ca (Moody's) or CC (S&P/Fitch) then a credit event is triggered. However, if the reference obligation is rated by two or more of Fitch, Moody's and S&P then a credit event is triggered only if it is downgraded to or below the above stated levels by at least two of these rating agencies.

This is different from a PAUG contract where a downgrade by any one agency is sufficient to trigger a credit event that allows the protection buyer to *physically settle*. Moreover, the rating levels that trigger default in a Cash Settle contract are one level below those in the PAUG contract (Caa2(Moody's) or CCC (S&P/Fitch)) and trigger a market valuation.

IV. Bankruptcy

This has primarily been added because some protection buyers require the inclusion of bankruptcy to satisfy regulatory capital requirements since there is little chance of this in an ABS, which by definition, is structured as a "bankruptcy-remote" special purpose vehicle. This credit event gets triggered if the Reference Entity (issuer of the reference obligation) either

a) gets dissolved (other than for a merger, amalgamation or consolidation), or

b) makes a general assignment with or for its creditors, or

c) institutes or has instituted against it bankruptcy proceedings that either result in bankruptcy or are not dismissed within thirty calendar days, or

d) has a resolution passed for its liquidation or wind-up, or

e) seeks or becomes subject to the appointment of an administrator or other similar official for all or substantially all of its assets (This obviously excludes the appointment of an official such as a trustee solely for the issue of securities), or

f) has all or substantially all of its assets possessed by a secured party or has a legal process like attachment, distress proceedings etc. levied on them and this situation is not remedied within thirty calendar days, or

g) causes or is subject to any event that has an effect analogous to the above, or

Bankruptcy also includes the event where the occurrence of any of the conditions above leads to an event of "default" under the terms of the reference obligation.

The ISDA Cash Settle confirm does not have any explicit provisions for a step-up in the Fixed Rate with the stepping-up of the rate on the reference obligation. However, ISDA does "advise" counterparties to consider including this step-up feature in the Fixed Rate in line with any such feature in the reference obligation.

Valuation After Credit Event

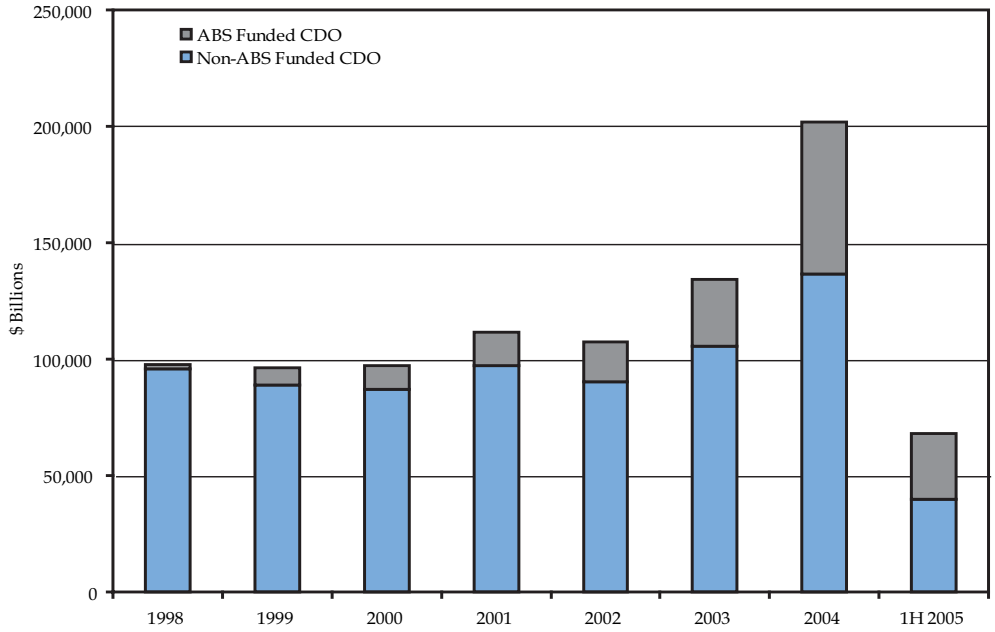
The protection seller has the right to choose any business day between 120 and 140 calendar days after the credit event date as the Valuation Date. The valuation of the reference obligation is done by sourcing bids from at least five Dealers (of which two each can be selected by the protection seller and the protection buyer). The required bid amount is at least $500,000 or is the lower of the reference obligation Notional Amount on the credit event date and the reference obligation aggregate Outstanding Principal Balance on the day the quotation is sought. The bids exclude any accrued interest (so any PIKed interest is not included) and the highest bid is chosen as the Final Price.

The calculation agent needs to receive quotations on either the notional amount or the outstanding principal balance ("full quotations") from at least two dealers and will average these to determine the Final Price of the reference obligation. If it cannot source full quotations from at least two dealers, the calculation agent shall continue to try and source bids on every fifth business day till sixty calendar days after the Valuation Date. If after this period only one full quotation is available then the Final Price is this quotation. However, if no full quotation is available then a weighted average of any available quotations is taken for valuation purposes. If no quotations are available then the Final Price is deemed to be zero.

If the reference obligation ceases to exist because the outstanding principal balance is reduced to zero and the underlying assets have been disposed off then the settlement method is Cash Settle and the Final Price is taken as zero.

However, this process can become challenging because at present there is a very small investor base for distressed ABS. This is primarily because of the continuance in negative performance of such bonds and the lack of information and transparency in the market. Moreover, liquidity and thus information dissemination, tends to be lesser in ABS deals since they tend to be smaller than the average corporate bond issuance and the number of investors exposed to a given name is smaller. Also, the increased exposure to ABS by CDOs reduces the volume of secondary trading and available-for-sale bonds in the market because a CDO will often purchase an entire tranche and hold it to maturity, even if prices reach levels where trading has a high economic incentive. As shown in Figure 13, ABS CDOs as a percentage of total CDOs have grown to 41% of all newly funded CDOs.

Figure 13: CDO Issuance



On account of this it may be difficult to get realistic bids in sufficient size for the distressed ABS bond from a sufficient number of dealers and there might be considerable dispersion of prices. This situation might improve as the market matures and there are more takers of distressed ABS but the possibility does seem remote at present.

Impact on Synthetic ABS-CDO Ratings

The ISDA market valuation time-frame for Cash-Settle Asset-Backed CDS also impacts synthetic ABS CDO ratings adversely. This is because rating agencies are concerned about accurate valuations in such a short time frame and "haircut" the cash recovery value estimates based on the liquidity of the security and/or the time to settlement.

Table 2: Moody's Recovery Adjustments for Synthetic ABS CDOs

Time To Settlement	Percentage of Recovery Assigned	
	Liquid Securities	Illiquid Securities
3 Months	25%	15%
6 Months	75%	50%
1 year	95%	65%
2 year	100%	90%

Table 3: S&P Recovery Adjustments for Synthetic ABS CDOs

Time To Settlement	Percentage of Recovery Assigned
45 days	25%
180 days	50%
> 360 days	90%
At Maturity	100%

Many synthetic CDOs use a long cash settlement period to avoid these haircuts but that would produce a documentation mismatch between the CDS and the CDO.

We believe that this market valuation process creates an additional risk in the Cash Settle contract and in CDOs referencing this contract and is another important factor because of which the PAUG contract (which does not have to go through a valuation) is becoming the market standard.

Fixed Recovery CDS Contracts

One solution that the market has evolved to take care of market valuation risk is to trade the CDS contract with a fixed recovery. This has been observed as the norm in the few CDS on CDOs that have started trading in the past few weeks. In such a contract the recovery value of the reference obligation is fixed at initiation and there is no need for the market valuation process on default. However, this does create a basis risk for the protection seller between realized recovery after default and the fixed recovery rate of the contract. An increase in volumes in such a market will probably give an impetus to developing a market in recovery swaps on Structured Finance reference obligations in the near future.

At present almost all of the US Asset-Backed CDS are traded PAUG/Physical Settle while contracts traded in Europe are traded Physical/Cash Settle to match documentation in existing ABS CDOs. The total outstanding notional of Cash-Settle Asset-Backed CDS is a minor fraction of the outstanding PAUG notionals. We believe that the structural features of the PAUG contract that enable it to mirror the cash flows of the underlying reference obligation and take away any market valuation risk are convincing counterparties to trade Asset-Backed CDS as PAUG. Table 4 highlights some of the differences between the PAUG contract and the Cash-Settle contract.

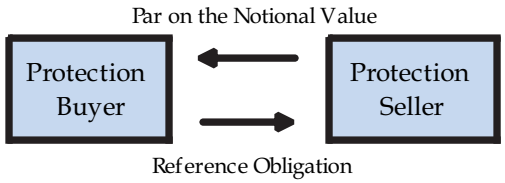
Table 4: PAUG vs Cash-Settle

Characteristic	PAUG Asset-Backed CDS	Cash Settle ABS
Scheduled Termination	Legal Final Maturity of ABS Bond	5 years at present (other maturities might develop)
Settlement Method	- Physical (PB's Option) - Pay As You Go (Actual losses)	- Physical (PB's Option) - Cash (Valuation Process)
Valuation Method	- Not Applicable - Actual Loss suffered	- One Point in Time -Needs Minimum Number of Quotations
Assignment	-Available (subject to counterparty approval) - Cash transfer is based on cash flow valuation	-Available (subject to counterparty approval) - Cash transfer is based on cash flow valuation
Premium (Fixed Rate)	Fixed at Origination Adjusted for shortfalls or reimbursements and step-up	Fixed at Origination
Floating Rate	- Interest Shortfalls - Principal Shortfalls - Writedowns	Not Applicable
Failure to Pay	- Includes only failure to pay Principal	- Includes failure to pay Principal or Interest - Failure should be greater than $100,000
Writedown	- Includes Implied Writedown	- Only actual writedown or loss event
Ratings Downgrade	- Caa2 (Moody's) / CCC (S&P/Fitch) - Any one rating agency can downgrade - No credit event if rating withdrawn from a specific level and assigned again at a specific level within 3 calendar months	- Caa (Moody's) / CC (S&P/Fitch) - If rated by multiple agencies two or more should downgrade - Not Applicable
Maturity Extension	- Can be used to trigger settlement option	- Not Applicable
Bankruptcy	- Not Applicable	- Exists
Interest Shortfall	Three Variants - Fixed Cap - Variable Cap - Not Applicable	Not Applicable
Market Valuation	Not Applicable	Required at Default
Most Commonly Traded in	US	Europe

III. Physical Settle Option under PAUG or Cash-Settle Asset-Backed CDS

In a PAUG contract, in case there is a credit event, the protection buyer has the option to physically settle and deliver the underlying reference obligation or continue with the existing contract. This option can be exercised by the protection buyer after the conditions to settlement are met.

Figure 14: Physical Settle ABS Economics



Similarly, in a Cash-Settle contract, the protection buyer can opt for delivering the underlying reference obligation after a credit event. When protection buyers choose to physically settle, they have thirty days after the credit event to deliver the reference obligation. In addition to the amount payable by the protection seller for the delivered reference obligation, the protection seller also has to pay any accrued but unpaid interest up to and including the delivery date. However, this accrued interest is only paid on the lower of the reference obligation amount delivered and the total reference obligation notional amount on the delivery date. If the outstanding principal balance is lower than the notional amount then physical settlement shall apply to the outstanding principal balance and cash settlement shall apply to the difference between the notional amount and the outstanding principal balance.

In either case - PAUG or Cash Settle- we believe that counterparties in this market will probably not opt for a physical settlement of the full notional of the contract because it is very difficult to source the underlying reference obligation. This is because in most cases the notional amount of the CDS written on a particular reference obligation is a large multiple of the outstanding cash security. Credit Card Master Note Trusts might be an exception to this since any shortfall or excess spread in these is applied pro-rata to all outstanding tranches with the same priority.

Another factor working against physical settlement is the possibility of the current holders of the reference obligation applying a short squeeze on the market during the settlement process as demand outstrips the supply of the reference obligation.

In fact, we recently saw an example of this in the corporate CDS space after the default of Delphi. The indentures of most of the single-name CDS on Delphi required a physical settlement of the bond in case of a credit event. However, over time the outstanding notional of the synthetic contracts on CDS had become a multiple of the outstanding bond issuance of Delphi. This led to a short squeeze in the market that saw prices on the bond rising from approximately 45 levels just after the default to approximately 70 in a couple of weeks. The effect has since been muted to some extent on account of netting of protection bought and sold contracts between two counterparties. This has brought down the net outstanding notional of the CDS contract leading to some sanity in the market. However, this experience is a manifestation of the difficulties inherent in physical settlement as the size of the synthetic market grows.

Let us now look at a simple example to understand the cash flows under both the settlement options of an Asset-Backed CDS. The reference obligation on which the CDS is written has the following characteristics:

Outstanding Reference Obligation Notional	10,000,000
Reference Obligation Coupon	LIBOR+300 bp
Monthly Scheduled Interest Payment (on $10 Million)	60,417
Rating	BBB
CDS Spread	250
CDS Notional	1,000,000
Monthly CDS Premium	2083.33

We assume the occurrence of credit events, after two parties have entered into a CDS trade, according to the schedule given in Table 5 below and look at the obligations of both the protection seller and the protection buyer under each of these scenarios.

Table 5: PAUG Asset-Backed CDS

Time	Credit Event	Default Amount		Action	
				Protection Seller Pays	Protection Buyer Pays
Month 1	Reference Obligation Interest Payment	30,208	PAUG	Interest Shortfall Cases Illustrated in Figure 10	
	Therefore Reference Obligation Interest Shortfall	30,208	Physical Settle	Not Applicable	
	Therefore CDS Interest Shortfall	3,021			
Month 4	Reference Obligation Writedown	100,000	PAUG	10000	2062.50
	Therefore CDS Writedown	10,000	Physical Settle	Par	Deliver ABS Reference Obligation
Month 8	Reference Obligation Writedown Reimbursement	25,000	PAUG	Zero	4567.71
	Therefore CDS Writedown Reimbursement	2,500	Physical Settle	Not Applicable	
Month 12	Ratings Downgrade to CCC (or below)		PAUG	Zero	2067.71
			Physical Settle	Par	Deliver ABS Reference Obligation

In the first month after the CDS contract the reference obligation has an interest shortfall and in the fourth month it has a writedown event. The writedown of $100,000 on the reference obligation outstanding notional of $10 million implies a write-down of $10,000 for someone holding $1 million of these cash bonds. Under the PAUG option this is the amount that is paid by the protection seller to the protection buyer who has bought protection on a notional of $1 million. However, now the outstanding notional of the CDS contract decreases by that amount and the 250bp are paid on a lower notional of $990,000. The calculations for interest shortfall and writedown reimbursements are done the same way. After the write-down reimbursement the notional on the CDS contract goes up again to $992,500 and the premium is calculated on this new notional. In the twelfth month the reference obligation gets downgraded to CCC. This event has no effect under the PAUG contract other than to trigger a settlement option. In case the protection buyer does not exercises this option the protection payments continue as before. However, if the protection buyer does exercise this option it leads to a physical settlement of the trade.

Under Cash Settle, as mentioned earlier, the added risk is that one can not ascertain the "permanence" of the shortfall or writedown amount within a reasonable time interval of such an event occurring. Table 6 below shows the cash flows for each credit event if the shortfall or writedown can or can not be deemed permanent with certainty. The notional of the CDS contract is not reduced if the reference obligation writedown is not deemed to be permanent. Therefore, even though the reference obligation notional effectively goes down after the writedown, the CDS contract still pays 250 bp on the original notional. In addition, since the cash settle contract terminates after the first "default" event any subsequent writedown reimbursements do not affect cash flows.

Table 6: Cash-Settle Asset-Backed CDS

Time	Credit Event	Default Amount		Action	
				Protection Seller Pays	Protection Buyer Pays
Month 1	Reference Obligation Interest Payment	30,208	Case 1	If shortfall deemed to be irreversible or outstanding for a long time	
	Therefore Reference Obligation Interest Shortfall	30,208	Cash Settle	Par - Market Value	Zero
	Therefore CDS Interest Shortfall	3,021	Physical Settle	Par	Deliver ABS Reference Obligation
			Case 2	If shortfall not deemed irreversible or not outstanding for a short time	
			Cash Settle	Zero	2,083.33
			Physical Settle	Zero	2,083.33
Month 4	Reference Obligation Writedown	100,000	Case 1	If writedown deemed to be irreversible or outstanding for a long time	
	Therefore CDS Writedown	10,000	Cash Settle	Par - Market Value	Zero
			Physical Settle	Par	Deliver ABS Reference Obligation
			Case 2	If writedown not deemed irreversible or not outstanding for a short time	
			Cash Settle	Zero	2,083.33
			Physical Settle	Zero	2,083.33
Month 8	Reference Obligation Writedown Reimbursement	25,000	Cash Settle		
	Therefore CDS Writedown Reimbursement	2,500	Physical Settle		
Month 12	Ratings Downgrade to CCC (or below)		Cash Settle	Par - Market Value	2,083.33
			Physical Settle	Par	Deliver ABS Reference Obligation

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SECTION VI: VALUATION of ASSET-BACKED CDS

Asset-Backed CDS Pricing

Similar to corporate CDS, pricing on Asset-Backed CDS is dependent on the pricing of the underlying cash bond. ABS cash bonds are historically valued by their DM over LIBOR and this practice has carried over into PAUG Asset-Backed CDS which uses the cash bond DM as the first step towards pricing.

As a first cut, the CDS spread can be approximated by the price of an unfunded par floater on the cash bond. This prices the CDS at the difference of the par cash bond DM and the funding level of the dealer writing the CDS. Assuming a common market-wide funding cost of LIBOR, this method prices the Asset-Backed CDS at the DM of the underlying cash instrument. The first cut on fixed rate bonds could also be found from the DM on the bond which gives a measure of the equivalent floating spread over LIBOR on the bond.

This pricing works cleanly for the most part for the PAUG contract since the cash-flows on the CDS and the cash bond are the same. However, there are nuances in pricing that will come up based on, among other things,

i) Interest Shortfall Cap

The Variable Cap / No Cap variants mirror the cash flows on the cash bond and thus could possibly be priced using the above mentioned methodology. However, the Fixed Cap should be priced at a spread lower than these since the Available Funds Cap risk of the Protection Seller is capped at the Fixed Rate.

ii) Premium/Discount bonds

The Reference Price in the PAUG contract is set at par unless the bond is at a deep discount or high premium in which case that is reflected. If the bond is not at a deep discount or high premium then the DM is on many occasions just multiplied (thus reduced or increased) by the price of the bond to get the effective CDS spread on the cash bond. This will give rise to some basis risk since the DM of non-par ABS bonds is not a linear function of the par DM.

iii) Fixed Rate Bonds

The DM on fixed rate bonds is usually a measure of not just the credit risk on the bond but also of any changes in the interest rate curve. Therefore, an asset swap on the fixed rate bond to convert it to a floater will give different spread levels at different times based on the existing interest rate curve in the market.

iv) Day Count Convention

The day count convention used for interest calculations in Asset-Backed CDS is Actual/360 which may not always match the day count convention used in the underlying cash ABS bonds. For example, fixed rate ABS cash bonds use a day count convention of 30/360. The difference in day-count conventions between the underlying cash bonds and the CDS will lead to "true" CDS premium being different from the cash bond DM.

v) Implied Writedown

All PAUG CDS contracts include implied writedowns as a credit event while this is not an obvious credit event in cash bonds. Undercollaterization might not lead to immediate interest shortfalls or writedowns on a bond. Moreover, it might not lead to immediate interest shortfalls on all tranches in a securitization e.g. the higher tranches that have a lower coupon than the portfolio WAC might not have an interest shortfall in case of undercollaterization but the lower tranches might do so. More than anything this credit event creates a difference in time value of cash flows between the cash bond and the CDS contract.

The pricing of Cash-Settle Asset-Backed CDS will also differ from that of the PAUG contract on account of a few variations in the structure of the contract in addition to the fact that a credit event leads to market valuation.

i) Market Valuation

The market valuation of the bond after default might be very different from any estimated value owing to the lack of liquidity and depth in the market for distressed ABS. This will cause the fair spread on a cash-settle Asset-Backed CDS to be typically higher than that on a PAUG contract as investors will demand a higher risk premium to offset the market valuation risk.

ii) Rating Triggers

Rating downgrade triggers are a level lower in cash-settle Asset-Backed CDS and trigger a market valuation of the cash bond. The timing and level of a ratings action is much more important in a cash settle Asset-Backed CDS than in a PAUG contract. In a PAUG contract, for a bond that has started writing down, having no concurrent ratings action to the trigger levels will have no material affect on cash flows because all writedowns are exchanged between the protection seller and the protection buyer. However, in a Cash-Settle contract, if there is no rating action down to the trigger levels the protection buyer will not be able to effect a settlement and receive the requisite protection cash flows (assuming no other credit event triggers have been hit). This loses the protection buyer valuable time value of money on writedown amounts because there can be a long gap between the start of writedowns and any rating action to reflect the writedowns. This implies that investors in a cash-settle contract will demand a premium for taking on this additional risk over the PAUG contract.

iii) Accrued Premium

In a cash-settle contract, after a credit event, the protection buyer pays the protection seller the market price of the reference obligation in return for par. Similar to a forced settlement on a cash bond, this market price does not include accrued interest in case the credit event happens between two scheduled payment dates. However, the protection seller still gets accrued premium for that period. This situation does not arise in PAUG contracts because there is no forced market valuation, thus not giving the protection seller any additional income over holding a cash bond. This accrued premium is additional income earned by the protection seller in Asset-Backed CDS over holding a cash bond and should lead to a lower CDS premium than the cash bond DM or the PAUG CDS premium to compensate for the same.

iv) Implied Writedown

This is taken as a credit event under standard PAUG contracts but is not considered a credit event for cash-settle contracts. Therefore, under the PAUG contract the CDS notional would be reduced and there will be a protection payment to the extent of the writedown. On the other hand, under the cash-settle contract there would be no impact on cash flows if the cash bond does not suffer an interest shortfall or actual writedown in the same period. Therefore there might a lag in protection payments under the cash-settle contract leading to a loss of time value for the protection buyer. This will be offset a bit because protection buyers would start paying premium on a lower notional amount earlier in the PAUG contract.

All the above factors call for a valuation of Asset-Backed CDS using a more robust method just as corporate CDS graduated to using a hazard rate approach to valuation. Risk-neutral pricing, as used in corporate CDS will be much more complex to implement here because of the various unique features of ABS bonds. For example, bootstrapping a survival curve for say subprime reference obligations can prove to be difficult. This is because such reference obligations are usually issued with the same average life so to bootstrap across average lives we would end up comparing bonds with different seasoning profiles, making the whole exercise futile. Also, a simple approach like using the spread duration of the bond might make the valuation too rough on account of the prepayment and default characteristics of ABS bonds.

In general, there are two possible approaches to deriving "fair-value" spreads for credit default swap contracts. We look at these two approached for valuing a PAUG Asset-Backed CDS below.

Risk-Neutral Pricing

A risk-neutral default rate is first derived from the market prices of cash bonds. These default rates are then used to generate the cash flow stream that the protection seller is liable for. The fixed spread on the premium leg is then iteratively solved for by equating the present value of the protection payments to the present value of the premiums received by the protection seller.

At a zero option adjusted spread (OAS) an bond is deemed to have "risk-neutral" cash flows since zero OAS implies zero compensation for risk which in turn implies that the bond is similar to a risk-neutral instrument. Thus, one could find out the cash flows of the ABS reference obligation that make it a zero OAS security and use these risk-neutral cash flows to price the credit default swap.

However, in reference obligations like ABS it can get tricky to get a set of zero OAS cash flows because of the prepayment and default characteristics of the bond. We believe that since the CDS mirrors the cash bond we should take the same prepayment and default assumptions as we use for valuing the cash bond. In our case, we use our proprietary Econometric Prepayment Model (EPM) and the Econometric Default Model (EDM).

We run the underlying reference obligation (*at its current market price*) through a Monte Carlo simulation that factors in different interest rate paths and thus different prepayment and default scenarios. This simulation gives us an option adjusted spread (OAS) on the bond which is a measure of the credit and prepayment risk of the bond.

The OAS obtained from such a simulation is then taken to zero by changing the EDM multiple in our model. However, this tweaking can lead to a change in the duration of the bond. To rectify this, we add another constraint - while keeping the OAS zero, change the EPM multiple on the bond so that the duration remains the same as under base EPM and EDM.

This implied risk-neutral probability of default (EDM) and prepayment (EPM) across the Monte Carlo paths then allows us to generate a set of risk-neutral cash flows for the reference obligation. We use this set of cash flows to obtain the writedowns and shortfalls on the bond. These writedowns and shortfalls make up the set of floating (payment on default) cash flows. The fixed spread that gives the same PV (discounting done at the LIBOR curve since these are risk-neutral cash flows) as these floating cash flows would be the fair CDS spread for the bond.

Using ABS bonds with different durations, a term-structure of default probabilities can be constructed for Asset-Backed CDS on a particular reference obligation. However, this would not be very accurate because bonds with different seasoning profiles would behave quite differently. We will look at the effect of seasoning in a separate publication.

This approach takes care of any pricing variations on account of the reference price of the bond since we run the OAS analysis at the market price of the bond. It also factors in any pricing variations because of the Interest Shortfall Cap variants used since the analysis takes place over a set of different simulated interest rate paths and changing prepayment speeds. The CDS spread on a bond with a Fixed Cap should be lower than the CDS spread on the same bond with a Variable Cap since in the Fixed Cap case the protection buyer's compensation is capped at the CDS spread while in the Variable Cap case the protection buyer receives protection for any shortfalls on account of AFC or PIKing up to LIBOR plus CDS Spread.

We have not considered a breach of rating triggers while pricing because such an event does not trigger a market valuation but only an option to physically settle. We believe that in most cases the PAUG contract would not be physically settled so at present we have left out any impact on pricing of a breach of rating triggers.

Static Replication Pricing

One can attempt to create a model-independent procedure to pricing by constructing a portfolio that replicates the upfront as well as default payoffs of the CDS contract. By comparing the cost or benefit of this replicating portfolio and invoking the principle of no-arbitrage, a range within which the CDS premiums should lie can be established. While this approach seems appealing in practice, a number of practical difficulties may arise in the construction of such a portfolio. As such, the analysis described under the static replication approach should be viewed as guidelines rather than as true arbitrageable trades. Nevertheless, it still serves a very important purpose in describing how the two parties to a CDS contract may approach the issue of hedging the risks they are taking on.

In order to simplify the analysis, we focus only on floating-rate reference obligations, leaving the complications arising from fixed-rate cash bonds to a later date. In addition, a large part of the effort made here is to define CDS premiums in situations where the underlying reference bond is trading away from par. At this stage, we also abstract away from real-world features such as differential treatment of available fund cap interest shortfalls as well as step-up coupons past the 10% clean-up call date. While important to the final calculations, they are not critical for our purpose. Unlike standard corporate CDS where the underlyings are non-amortizing, non-par pricing with prepayment risk creates an entirely new set of issues that need to be addressed.

Before we describe the process by which we arrive at no-arbitrage pricing bounds however, let us define a few terms. Accordingly,

PS: protection premium received by protection seller.

PB: protection premium paid by protection buyer.

C: coupon margin on floating rate reference obligation.

D: the market price discount/premium from par at which the reference obligation currently trades in the market.

F: the funding spread over LIBOR at which the marginal participant in the PAUG market can borrow at over the life of the reference bond.

R: the term repo rate earned by the purchaser of securities in a reverse-repurchase agreement. The term repo rate is assumed to apply until the maturity date of the reference bond as in a reverse-to-maturity transaction.

L{t}: one-month LIBOR at time t.

T*: The uncertain maturity date of the underlying reference obligation and PAUG CDS contract which is a function of prepayment and default rates on the collateral backing the transaction.

We attempt to derive pricing bounds in a situation where the underlying reference bond trades at prices of par, discount and premium and the reference prices on the CDS contract are respectively par, discount and premium. We will view the exercise from the perspective of both a protection buyer and a protection seller.

I. Par Priced Reference Obligation

1. Protection Buyer

For a par priced asset a long protection position paired off with a purchase of the cash asset creates an essentially risk-less position. The purchase of the cash asset requires the protection buyer to fund the purchase price at the protection buyer's cost of funds. Thus, the cash investment will require a periodic outflow of (L{t} + F). The protection payments constitute an additional outflow of funds amounting to PB. Note that all of these amounts are calculated off a notional amount of par. In exchange, the buyer receives a coupon of (L{t}+ C) on the cash asset. Thus, the no-arbitrage condition can be expressed as:

$$-PB - (L\{t\} + F) + (L\{t\} + C) = 0$$

This reduces to:

$$PB = C - F$$

Thus, from the perspective of the protection buyer, the protection premium paid must equal the coupon margin on the floating rate reference bond *minus* his funding cost.

To see that this creates a perfectly hedged position in the case of the PAUG contract, note that every dollar of prepayments and losses reduces the notional amount of both the protection leg and the borrowed position in the funded asset by an equivalent amount. Every dollar of prepaid principal and every dollar of principal writedown reimbursement received from the protection seller is passed through to the lender who has advanced funds for purchase of the cash asset. The protection buyer has a zero outlay on day one and is left with zero liability when the asset and the CDS notional have both amortized down to zero. Thus, for no money down, a risk-less position is created which must, by the law of one price, generate zero return. The sequence of trades and periodic cash flows are summarized in Table 7. The table shows periodic cash flows and the cumulative flows at maturity under the two extremes of there being either only writedowns or only prepayments on the bond. The flows under any other scenario will always fall between these two - in this case the bounds are 0 for both cases.

Table 7: Long Protection in CDS Hedged with Cash Bond

	Time	CDS	Loan	Bond	Total Flow
Amount Invested	t=0	0	1	-1	0
Cash Flow	t=1	-PB	-(L+F)	+(L+C)	-PB + (C-F)
Bond Has Only Write Downs	t=T*	1	-1	0	0
Bond Has Only Prepayments	t=T*	0	-1	1	0

2. Protection Seller

A short position in protection (i.e. a long risk position) can be offset by engaging in a reverse-repurchase transaction that has the effect of creating a short position in the underlying reference obligation. In the reverse-repo, the protection seller lends cash equal to the market value of the bond to the bond holder and borrows the underlying reference bond in return (we assume no haircut to simplify matters). The bond is immediately sold it in the market at its current price. Strictly speaking, this would be akin to a reverse-to-maturity transaction in which the reverse-repo counterparty agrees to pay a repo spread to the short-seller and continues to receive all principal and interest payments on the collateral until the maturity date and gives back borrowed cash on account of any prepayments or writedowns.

Every dollar of prepayment on the reference bond is passed through to the original holder of the reference obligation by simultaneously liquidating a dollar from the reverse-repo lending account. In addition, every dollar of loss on the tranche, if it occurs, also leads to a dollar of liquidation from the reverse-repo lending account which is passed through to the protection buyer. In this fashion, the balance of the reverse repo account and the reference bond track each other perfectly. The various legs of the transaction, from a periodic cash flow perspective, can be summarized as follows:

PS + (L{t} + R) - (L{t}+C) = 0

This can be reshuffled to arrive at

PS = C - R

In other words, from the perspective of the protection seller, the premium received has to be at least equal to the coupon margin minus the repo rate on the underlying reference bond in the reverse-repurchase market. The sequence of trades and cash flows is summarized in Table 8. The table shows periodic cash flows and the cumulative flows at maturity under the two extremes of there being either only writedowns or only prepayments on the bond. The flows under any other scenario will always fall between these two - in this case the bounds are 0 for both cases.

Table 8: Short Protection in CDS Hedged by Shorting Cash Bond

	Time	CDS	Reverse Repo	Bond	Total Flow
Amount Invested	t=0	0	-1	1	0
Cash Flow	t=1	PS	L+R	-(L+C)	PS+(L+R)-(L+C)
Bond Has Only Write Downs	t=T*	-1	1	0	0
Bond Has Only Prepayments	t=T*	0	1	-1	0

II. Discount Priced Reference Obligation

The discount could have resulted either from standard new issue pricing convention where bonds are structured with a below-market coupon at the expense of discount proceeds or from a widening of credit spreads in the market since the issue date of the bond. As stated earlier, we represent the discount from par by the symbol D. We will alternately examine the pricing relationship from both a protection buyer and a seller's perspective.

1. Protection Buyer

As in the par bond case, a long protection position paired off with a purchase of the cash bond creates a "hedged" position. However, the discount dollar price of the cash asset creates an additional complication that must be addressed so that the hedging is complete. In this case, the protection buyer borrows (1-D) to pay for the purchase of $1 of face amount of the reference asset since it is trading at a discount of D from par.

Every dollar of principal repayment on the bond is used to reduce the borrowed amount by a dollar. However, while every dollar of loss reduces the CDS notional and the face amount of the reference bond by $1, default payments received by the protection buyer are capped at (1-D) since that is the reference price on the CDS. Thus, for every dollar of principal write-down, only (1-D) dollars are available to repay the borrowing.

Depending on the pattern of prepayments and write-downs, the balance of the borrowing has a maximum value of 0 if the entire tranche is written down. If every dollar were to be prepaid, there would be redemptions in excess of the amount borrowed, leaving the protection buyer with a credit equal to D dollars. Based on this mix of prepayments and writedowns there will be a date at which the balance of the loan is paid down to zero. After this date, the financing cost of the loan is reduced to zero obviously and any further prepayment would lead to a credit for the protection seller.

The cash flows are summarized in Table 9. The table shows periodic cash flows and the cumulative flows at maturity under the two extremes of there being either only writedowns or only prepayments on the bond. The flows under any other scenario will always fall between these two - in this case the bounds are 0 (only writedowns) and D (only prepayments).

Table 9: Long protection in CDS Hedged with Discount Cash Bond

	Time	CDS	Loan	Bond	Total Flow
Amount Invested	t=0	0	1-D	-(1-D)	0
Cash Flow	t=1	-PB	-(L+F)*(1-D)	+(L+C)	-PB+(C-F)+D*(L+F)
Bond Has Only Write Downs	t=T*	1-D	-(1-D)	0	0
Bond Has Only Prepayments	t=T*	0	-(1-D)	1	D

Accounting for this, the no-arbitrage condition can be expressed as:

$$-PB - (1-D) * (L\{t\} + F) + (L\{t\}+C) + PV(D\{T\})/DV01 = 0 \qquad 0 < D\{T\} > D$$

This can be rearranged to yield

$$PB = (C-F) + D*(L\{t\}+F) + PV(D\{T\})/DV01$$

where PV(x) is the present value of x dollars in the future and DV01 is the Dollar-Value of a Basis Point for the expected duration of the borrowing. Appendix II shows detailed cash flows for such a case.

2. Protection Seller

As indicated earlier, a protection seller can hedge his risk by engaging in a reverse-repurchase transaction and "shorting" the cash bond. In addition, the reference price principal write-down adjustment also needs to be accounted for as before. The mechanics of the trade in this situation are summarized in Table 10. The table shows periodic cash flows and the cumulative flows at maturity under the two extremes of there being either only writedowns or only prepayments on the bond. The flows under any other scenario will always fall between these two - in this case the bounds are 0 (only writedowns) and -D (only prepayments).

Table 10: Short Protection in CDS Hedged by Shorting Discount Cash Bond

	Time	CDS	Reverse Repo	Bond	Total Flow
Amount Invested	t=0	0	-(1-D)	1-D	0
Cash Flow	t=1	PS	(L+R)*(1-D)	-(L+C)	PS+(L+R)*(1-D)-(L+C)
Bond Has Only Write Downs	t=T*	-(1-D)	1-D	0	0
Bond Has Only Prepayments	t=T*	0	1-D	-1	-D

Every dollar of loss or prepayment on the underlying implies a dollar of liquidation of the money-market account. However, if defaults occur, since only (1-D) of the dollar has to be paid out to the protection buyer, D dollars can be set aside for paying the loan down. This implies that the balance of the loan will decline based on the rate of defaults being applied to the reference obligation. At the maturity date of the reference obligation, the protection seller is still on the hook for the D dollars borrowed at the inception of the trade minus any loan redemptions from the liquidation proceeds from the reverse-repo lending account. At maturity, there is the possibility that some part of the loan is still outstanding and this has to be accounted for as part of the premium that the protection seller needs to receive. The adjustment can be roughly approximated by:

$$PS + (1-D) * (L\{t\} + R) - (L\{t\}+C) + PV(D\{T\})/DV01 = 0 \qquad -D < D\{T\} > 0$$

$$PS = (C - R) + D*(L\{t\}+R) - PV(D\{T\})/DV01$$

where PV(x) is the present value of x dollars in the future and DV01 is the Dollar-Value of a Basis Point for the expected duration of the borrowing.

III. Premium Price Reference Obligation

In this section, we consider the case of a floating rate reference obligation which is trading at a premium to par. The premium could possibly have resulted from a narrowing of credit spreads in the market since the issue date of the bond. As stated earlier, we represent the deviance from par by the symbol D. We will alternately examine the pricing relationship from both a protection buyer and a seller's perspective.

1. Protection Buyer

As in the par bond case, a long protection position paired off with a purchase of the cash bond creates a "hedged" position. However, the premium dollar price of the cash asset creates an additional complication that must be addressed to make the hedging complete. In this case, the protection buyer borrows (1+D) to pay for the purchase of a $1 of face amount of the reference asset since it is trading at a premium of D from par. The cash flows are summarized in Table 11. The table shows periodic cash flows and the cumulative flows at maturity under the two extremes of there being either only writedowns or only prepayments on the bond. The flows under any other scenario will always fall between these two - in this case the bounds are 0 (only writedowns) and -D (only prepayments).

Table 11: Long protection in CDS Hedged with Premium Cash Bond

	Time	Total Flow	CDS	Loan	Bond
Amount Invested	t=0	0	0	1+D	-(1+D)
Cash Flow	t=1	-PB-(L+F)*(1+D)+(L+C)	-PB	-(L+F)*(1+D)	+(L+C)
Bond Has Only Write Downs	t=T*	0	1+D	-(1+D)	0
Bond Has Only Prepayments	t=T*	-D	0	-1	1

Every dollar of loss reduces the CDS notional and the face amount of the reference bond by a (1+D) due to the reference price adjustment. However, for every dollar of principal prepaid, only one dollar is available to repay borrowings. Depending on the pattern of prepayments and write-downs, the balance of borrowings has a maximum value of D if the entire tranche is prepaid down. If every dollar were to be written down however, the CDS payments would exactly cover the amount borrowed. Accounting for this, the no-arbitrage condition can be expressed as:

$$-PB - (1+D) * (L\{t\} + F) + (L\{t\}+C) + PV(D\{T\})/DV01 = 0 \qquad -D < D\{T\} > 0$$

This can be rearranged to yield

$$PB = (C-F) - D*(L\{t\}+F) + PV(D\{T\})/DV01$$

where PV(x) is the present value of x dollars in the future and DV01 is the Dollar-Value of a Basis Point for the expected duration of the borrowing.

2. Protection Seller

As indicated earlier, a protection seller can hedge his risk by engaging in a reverse-repurchase transaction and "shorting" the cash bond. However, the premium dollar price of the cash asset creates an additional complication that must be addressed to make the hedging complete. As before, the reference price principal write-down adjustment also needs to be accounted for. The mechanics of the trade in this situation are summarized in Table 12 below. The table shows periodic cash flows and the cumulative flows at maturity under the two extremes of there being either only writedowns or only prepayments on the bond. The flows under any other scenario will always fall between these two - in this case the bounds are 0 (only writedowns) and D (only prepayments).

Table 12: Short Protection in CDS Hedged by Shorting Premium Cash Bond

	Time	Total Flow	CDS	Reverse Repo	Bond
Amount Invested	t=0	0	0	-(1+D)	(1+D)
Cash Flow	t=1	PS-(C-R)+D*(L+R)	PS	(L+R)*(1+D)	-(L+C)
Bond Has Only Write Downs	t=T*	0	-(1+D)	1+D	0
Bond Has Only Prepayments	t=T*	D	0	1+D	-1

Every dollar of prepayment on the underlying implies a dollar of liquidation of the reverse-repo lending account. However, if defaults occur, since (1+D) of the dollar has to be paid out to the protection buyer, (1+D) dollars have to be set aside for paying the protection buyer. At maturity, there is the possibility that some part of the reverse-repo account is still outstanding. This could occur for example if there were no tranche write-downs and the tranche balance was reduced to zero through principal repayments only. The adjustment can be roughly approximated by:

$$PS - (C - R) - D*(L\{t\}+R) + PV(D\{T\})/DV01 = 0 \qquad 0 < D\{T\} > D$$

$$PS = (C-R) +D*(L\{t\}+R) - PV(D\{T\})/DV01$$

where PV(x) is the present value of x dollars in the future and DV01 is the Dollar-Value of a Basis Point for the expected duration of the borrowing.

Our analysis of no-arbitrage pricing bounds for PAUG swaps should reveal the complexities associated with reference bonds that are trading away from par. Arriving at the pricing bounds in the case of par obligations is almost trivial since we have assumed away some of the complications arising from differential cap treatment in the PAUG.

For non-par obligations, pricing bounds are dependent on assumptions about the rate of principal redemptions as well as the split between prepayments and defaults. Given the uncertainty about principal prepayments in the RMBS deals, this makes the job even harder. The no-arbitrage bounds derived here in these cases can at best be described as very rough guides that indicate the ordinality of the relationships between stated coupon margins and the fair spread on CDS contracts. In addition, the hedge-based pricing approach described here can be employed to seek arbitrage opportunities if market relationships between the various markets get so out of whack that the profit opportunity becomes painfully obvious and allows the obvious frictions and transactions costs to be overcome.

Unwind Valuation of Asset-Backed CDS

The valuation process laid out above allows us to value any outstanding Asset-Backed CDS from first principles. With the passage of time and as base-case prepayment and default assumptions change in the market, the PV of the fixed rate (CDS premium) will no longer balance the PV of the writedowns and shortfalls on the bond. The difference between the two PVs gives us a measure of the unwind value of the CDS contract.

At present though, the market has taken a leaf out of the corporate CDS world and uses a much simpler method to calculate the unwind value of the ABS credit default swap. The unwind value of a corporate CDS is calculated by multiplying the change in premium by the risky DV01 of the credit default swap. In simple terms, the risky DV01 of the corporate CDS is a product of its survival probability curve, risk-free discount curve and the notional of the CDS.

Similarly, one can find a measure of the DV01 of Asset-Backed CDS using the modified duration of the cash bond since the CDS mirrors the cash bond to a large extent. Under current market convention, the dealer finds the modified duration of the cash bond at its market price and the dealer's base prepayment and default speeds. Then it is just a simple matter of multiplying this by the outstanding notional of the CDS and the change in spreads to get the unwind value on the Asset-Backed CDS. Table 13 below gives an example of this unwind value for a investor who sold protection at 325 bp and unwound the trade at 250 bp.

Table 13: Calculating Unwind Value in Asset-Backed CDS

Bond Name	Mod Duration	Notional at Unwind	Spread at Initiation	Spread at Unwind	Unwind Value
Deal I - Baa3	3.75	10,000,000	325	250	281,250

This works reasonably well for CDS on ABS bonds trading at or near par. However, for ABS bonds trading at a big discount or premium, the modified duration of the cash bond could be very different from the duration of the CDS in case the reference price of the CDS is par or is very different from the price of the bond. It is on account of such nuances that we need to develop a more robust model to value the CDS than using a simplified measure like the bond's modified duration.

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SECTION VII: A LOOK AHEAD

A Look Ahead

We expect a rapid growth of the Asset-Backed CDS market to occur in the near future, especially with the publishing of standardization ISDA confirmation for both PAUG and Cash Settle contracts and with standard ISDA confirms for CDS on CDOs expected in the near future. Recent trading volumes in both the RMBS and CMBS space are a testament to the fact that the market is slowly coming to terms with the synthetic contract and is comfortable with its nuances. Using a back-of-the-envelope calculation, even if the synthetic ABS market grows to a size comparable to the corporate CDS market (when calculated as a percentage of cash bonds outstanding) it should grow to a notional size of over $1 trillion by 2009. We expect it to hit that point sooner if Asset-Backed CDS participants can leverage the familiarity of the investor base with corporate CDS to accelerate the growth of the market, an advantage that the pioneers of the corporate CDS market did not have.

Asset-Backed CDS indices should be the next frontier in the development of this market. Market opinion has already coalesced towards forming indices segregated by asset type and rating levels rather than a diverse ABS index that would include CMBS, RMBS, credit card receivables et al. The two indices soon to be launched are:

1. ABX: This is expected to reference 20 subprime RMBS issuers and shall have five sub-indices broken down by rating buckets - AAA, AA, A, BBB and BBB-. In essence ABX is going to be five different indices based on these five rating categories. The indices are expected to be settled under the Pay-As-You-Go (PAUG) format with Fixed Cap on Interest Shortfall and are expected to trade in price terms and not on spread terms.

2. CMBX: This is expected to reference a pool of US CMBS with the triple-A sub-index expected to lead the launch.

Similar to the corporate CDS market, the single-name CDS market coupled with the indices is expected to be a fore-runner of an increasingly liquid market in more complex trades like n-to-default baskets and other correlation trades.

Appendix I: Example of CDS Cash Flows

We ran cash flows for an existing deal (BSABS - 05HE4 M6) at our base prepayment speed and three times our base default rate to get a sense of the cash flows on the cash bond and the resulting cash flows on the CDS. We ran the deal at higher defaults than base defaults just to give an illustration of writedowns on a bond across time.

Table 14: Bond/CDS Profile: BSABS 05-HE4 M6

Rating	Nominal Spread	Tranche Balance	CDS Notional	CDS Premium
Baa3	180 bp	6,228,000.00	10,000,000.00	250 bp

The tranche suffers writedowns starting in month 42 and under the PAUG contract the protection seller has to make the protection buyer whole for these writedowns. The protection buyer continues to pay the CDS premium to the protection seller every month. However, the outstanding notional on which this is paid keeps getting reduced in line with the reduction in the outstanding notional of the cash bond after the writedowns. These payments continue till the tranche gets totally extinguished in month 184.

Under the cash-settle contract, the two counterparties would settle the deal at the first instance of a credit event - writedown at month 42 in this case. The protection seller pays par and receives the market value of the deal from the protection buyer.

In case the CDS contract is physically settled the protection buyer will deliver the bond - BSABS 05-HE4 M6 - to the protection seller while getting back par in return. Under a cash-settle contract this can be done at the first instance of the credit event - month 42. However, under the PAUG contract this can be done at any of the writedown dates for any portion of the CDS. Importantly, the entire notional of the CDS contract can not be settled physically under either CDS variant since the outstanding notional of the bond is lower than the notional of the CDS contract. The remaining portion will have to be cash settled if the two counterparties have agreed to physically settle notionals up to the tranche notional.

Table 15: Cash Bond and CDS Cash Flows

		Bond Cash Flows				CDS Cash Flows		
Month	Date	Writedown	Interest Paid	Interest Due	Interest Shortfall	CDS Notional	PB Pays	PS Pays
1.00	25-Nov-05	0	31,755.66	31,755.66	0.00	10,000,000.00	20,833.33	0.00
2.00	25-Dec-05	0	30,731.29	30,731.29	0.00	10,000,000.00	20,833.33	0.00
3.00	25-Jan-06	0	32,791.48	32,791.48	0.00	10,000,000.00	20,833.33	0.00
4.00	25-Feb-06	0	33,657.20	33,657.20	0.00	10,000,000.00	20,833.33	0.00
5.00	25-Mar-06	0	31,069.57	31,069.57	0.00	10,000,000.00	20,833.33	0.00
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42.00	25-Apr-09	222,955.69	41,156.99	41,156.99	0.00	9,642,010.77	20,087.52	357,989.23
43.00	25-May-09	311,665.30	38,439.54	38,439.54	0.00	9,141,584.79	19,044.97	500,425.98
44.00	25-Jun-09	294,811.67	37,693.80	37,693.80	0.00	8,668,219.88	18,058.79	473,364.92
45.00	25-Jul-09	268,991.19	34,619.53	34,619.53	0.00	8,236,313.66	17,158.99	431,906.21
46.00	25-Aug-09	255,941.47	34,019.79	34,019.79	0.00	7,825,360.76	16,302.83	410,952.91
47.00	25-Sep-09	244,247.04	32,348.83	32,348.83	0.00	7,433,185.04	15,485.80	392,175.72
48.00	25-Oct-09	228,246.15	29,759.13	29,759.13	0.00	7,066,701.17	14,722.29	366,483.86
49.00	25-Nov-09	221,513.96	29,255.97	29,255.97	0.00	6,711,026.86	13,981.31	355,674.31
50.00	25-Dec-09	206,020.94	26,905.43	26,905.43	0.00	6,380,228.95	13,292.14	330,797.91
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117.00	25-Jul-15	7,604.64	1,241.11	1,241.11	0.00	286,075.29	595.99	12,210.40
118.00	25-Aug-15	7,677.79	1,230.64	1,230.64	0.00	273,747.43	570.31	12,327.86
119.00	25-Sep-15	7,355.89	1,178.26	1,178.26	0.00	261,936.43	545.70	11,811.00
120.00	25-Oct-15	6,668.49	1,091.66	1,091.66	0.00	251,229.16	523.39	10,707.27
121.00	25-Nov-15	6,761.26	1,082.55	1,082.55	0.00	240,372.93	500.78	10,856.23
122.00	25-Dec-15	6,138.80	1,002.93	1,002.93	0.00	230,516.15	480.24	9,856.78
123.00	25-Jan-16	6,232.60	994.45	994.45	0.00	220,508.77	459.39	10,007.39
124.00	25-Feb-16	5,981.82	951.85	951.85	0.00	210,904.05	439.38	9,604.72
125.00	25-Mar-16	5,126.23	852.16	852.16	0.00	202,673.11	422.24	8,230.94
126.00	25-Apr-16	5,548.01	875.86	875.86	0.00	193,764.93	403.68	8,908.17
127.00	25-May-16	5,024.25	810.82	810.82	0.00	185,697.74	386.87	8,067.20
128.00	25-Jun-16	5,109.10	803.42	803.42	0.00	177,494.30	369.78	8,203.44
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166.00	25-Aug-19	1,186.43	108.47	108.47	0.00	23,888.20	49.77	1,904.99
167.00	25-Sep-19	1,141.09	100.39	100.39	0.00	22,056.01	45.95	1,832.19
168.00	25-Oct-19	1,021.28	92.62	92.62	0.00	20,416.18	42.53	1,639.82
169.00	25-Nov-19	1,050.45	85.6	85.6	0.00	18,729.53	39.02	1,686.66
170.00	25-Dec-19	939.38	78.44	78.44	0.00	17,221.21	35.88	1,508.32
171.00	25-Jan-20	972.99	72.01	72.01	0.00	15,658.93	32.62	1,562.28
172.00	25-Feb-20	940.33	65.43	65.43	0.00	14,149.08	29.48	1,509.84
173.00	25-Mar-20	781.89	57.71	57.71	0.00	12,893.64	26.86	1,255.44
174.00	25-Apr-20	885.45	53.76	53.76	0.00	11,471.92	23.90	1,421.72
175.00	25-May-20	794.18	47.8	47.8	0.00	10,196.74	21.24	1,275.18
176.00	25-Jun-20	827.53	42.45	42.45	0.00	8,868.02	18.48	1,328.73
177.00	25-Jul-20	741.92	36.9	36.9	0.00	7,676.75	15.99	1,191.27
178.00	25-Aug-20	773.45	31.92	31.92	0.00	6,434.86	13.41	1,241.89
179.00	25-Sep-20	748.16	26.74	26.74	0.00	5,233.57	10.90	1,201.28
180.00	25-Oct-20	669.58	21.73	21.73	0.00	4,158.46	8.66	1,075.11
181.00	25-Nov-20	700.63	17.25	17.25	0.00	3,033.49	6.32	1,124.97
182.00	25-Dec-20	627.93	12.58	12.58	0.00	2,025.26	4.22	1,008.24
183.00	25-Jan-21	658.2	8.39	8.39	0.00	968.42	2.02	1,056.84
184.00	25-Feb-21	603.13	4.01	4.01	0.00	(0.00)	(0.00)	968.42

Appendix II: Static Replication for a Discount Bond

Par	4,697,000.00	LIBOR L	435
Price / Loan Balance	4,227,300.00	Coupon C	300
Par - Price (D)	469,700.00	Financing Rate F	25
CDS Reference Price	0.9	Repo Rate R	5
Discount / Premium	0.1	DV01	5
Estimated Range:			
Bond Has only WriteDowns (Prepay Gain, X = 0)			
PB = (C - F) +D*(L+F) + PV(X)/DV01	321		
Bond Has only Prepayments (Prepay Gain, X = D)			
PB = (C - F) +D*(L+F) + PV(X)/DV01	521		

Period		Date	LIBOR	DF	CDS Premium	Loan Interest	Bond Interest	Prepayment Gain/Loss	Net Flow	CDS Protection Payment	Prepays	Writedown	Outstanding Bond/CDS	Outstanding Loan
0	Today	11/22/2005			-PB	-(1-D)*(L+F)	(L+C)	Positive					4,697,000.00	4,227,300.00
1	10.00	12/02/2005	3.64	0.999020941	(5,152.59)	(4,505.26)	8,663.36	0.00	-994.50	-	0.00	0.00	4,697,000.00	4,227,300.00
2	33.00	01/04/2006	3.64	0.995796841	(17,003.55)	(14,867.36)	28,589.07	0.00	-3,281.84	-	0.00	0.00	4,697,000.00	4,227,300.00
3	28.00	02/01/2006	3.80	0.992771456	(14,427.26)	(13,133.58)	24,841.91	0.00	-2,718.93	-	0.00	0.00	4,697,000.00	4,227,300.00
4	33.00	03/06/2006	3.98	0.988941186	(17,003.55)	(16,166.82)	30,052.97	0.00	-3,117.40	-	0.00	0.00	4,697,000.00	4,227,300.00
5	28.00	04/03/2006	4.15	0.985402438	(14,427.26)	(14,268.59)	26,120.54	0.00	-2,575.30	-	0.00	0.00	4,697,000.00	4,227,300.00
6	29.00	05/02/2006	4.26	0.981766814	(14,942.52)	(15,147.63)	27,469.62	0.00	-2,620.53	-	0.00	0.00	4,697,000.00	4,227,300.00
7	31.00	06/02/2006	4.32	0.977998414	(15,973.04)	(16,407.71)	29,606.76	0.00	-2,773.99	-	0.00	0.00	4,697,000.00	4,227,300.00
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161	28.00	04/01/2019	5.04	0.518331286	(834.56)	(7.65)	1,699.05	6,883.99	7,740.83	759.15	8,010.15	843.50	262,848.82	-6,883.99
162	31.00	05/02/2019	5.05	0.515510709	(893.87)	-	1,822.05	8,594.15	9,522.34	730.51	7,863.64	811.68	254,173.50	-15,478.15
163	33.00	06/04/2019	5.05	0.513219623	(920.13)	-	1,875.59	7,719.26	8,674.72	702.73	7,016.53	780.81	246,376.16	-23,197.40
164	28.00	07/02/2019	5.05	0.511283659	(756.77)	-	1,542.59	7,710.74	8,496.57	677.39	7,033.35	752.66	238,590.15	-30,908.15
165	30.00	08/01/2019	5.05	0.509217514	(785.20)	-	1,600.54	8,104.89	8,920.24	652.47	7,452.42	724.97	230,412.76	-39,013.04
166	33.00	09/03/2019	5.05	0.506954397	(834.11)	-	1,700.25	7,740.25	8,606.39	627.07	7,113.18	696.74	222,602.84	-46,753.29
167	29.00	10/02/2019	5.05	0.504973902	(708.16)	-	1,443.52	7,527.01	8,262.36	602.90	6,924.11	669.89	215,008.84	-54,280.30
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354	30.00	05/02/2035	4.89	0.245001173	(0.18)	-	0.36	29.39	29.57	0.73	28.66	0.81	25.00	-267,423.07
355	30.00	06/01/2035	4.89	0.244041672	(0.08)	-	0.16	19.29	19.38	0.23	19.07	0.25	5.68	-267,442.37
356	31.00	07/02/2035	4.89	0.243054135	(0.02)	-	0.04	5.03	5.05	0.02	5.01	0.02	0.65	-267,447.39
357	31.00	08/02/2035	4.89	0.242070595	(0.00)	-	0.00	0.65	0.65	-	0.65	0.00	0.00	-267,448.04
358	31.00	09/02/2035	4.89	0.241091034	-	-	-	0.00	0.00	-	0.00	0.00	0.00	-267,448.04
359	31.00	10/03/2035	4.89	0.240115438	-	-	-	0.00	0.00	-	0.00	0.00	0.00	-267,448.04

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